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A new contribution to the genus *Opisthacanthus* Peters, 1861 and in particular to the African species of the subgenus *Nepabellus* Francke, 1974 with the description of a new species from Mozambique (Scorpiones: Hormuridae)

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Abstract

A new species of Hormuridae scorpion belonging to the genus *Opisthacanthus* and to the subgenus *Nepabellus* is described based on specimens collected in dry forests located in the North of Mozambique. This contribution is the first one to the African species of the genus and subgenus in more than two decades.

Keywords: Scorpion, *Opisthacanthus*, *Nepabellus*, new species, Mozambique, dry forests.

Introduction

The genus *Opisthacanthus* Peters, 1861 which belongs to the family Hormuridae, was the subject of multiple studies performed in the last 45 years and even knew a complete revision of all species (Lourenço, 1987). In subsequent studies, the genus *Opisthacanthus* was definitely divided in three subgenera, *Opisthacanthus*, *Nepabellus*, and *Monodopisthacanthus* Lourenço, 2001 (Lourenço, 2001) and the species were equally accommodated in a number of species groups (for details refer to Lourenço *et al.*, 2018). With one exception, all the species distributed in continental Africa belong to the subgenus *Nepabellus*. The range of the genus and subgenus in Africa covers almost 7.5 million km^2 and Africa has also the highest diversity of groups. Nevertheless, only very

few novelties were proposed for the African *Nepabellus* since the description of *Opisthacanthus* (*N.*) *lamorali* Lourenço, 1981 from Zimbabwe (Lourenço, 1981). The single exception being a short note about possible subspecies in Central Africa proposed by Lourenço (2003). In contrast, a significant number of new species were proposed for the American group (Lourenço, 2017) but most of all to the Malagasy group (Lourenço *et al.*, 2018; Ythier, 2022).

Figs. 1-4. *Opisthacanthus* (*Nepabellus*) *mossambicensis* sp. n., habitus. 1-2. ♂ holotype. 3-4. ♀ paratype. 1,3. dorsal aspect. 2,4. ventral aspect. (Scale bar: 1 cm).

In the present contribution, a new species of *Opisthacanthus*, subgenus *Nepabellus*, is described from dry forests located in the extreme North of Mozambique.

The new species clearly belongs to the *O. asper* group of species. It represents the first species of the genus ever described from Mozambique and the first to be confirmed without ambiguity to the Northern range of this country.

Material and Methods

Illustrations and measurements were made with the aid of a Wild M5 stereo-microscope equipped with a drawing tube (camera lucida) and an ocular micrometre. Habitus photographs were made with a Canon EOS RP and Adobe Photoshop software. Map was made using Google Maps and Adobe Photoshop software. Measurements follow Stahnke (1970) and are given in mm. Trichobothrial notations follow Vachon (1974) and morphological terminology mostly follows Hjelle (1990). The type material is deposited in the collections of the Muséum national d'Histoire naturelle, Paris, France.

Taxonomic treatment

Family **Hormuridae** Laurie, 1896
Genus ***Opisthacanthus*** Peters, 1861
Subgenus ***Nepabellus*** Francke, 1974
***asper* group**
Opisthacanthus asper (Peters, 1861)
Opisthacanthus basutus Lawrence, 1955
Opisthacanthus rugiceps Pocock, 1897

Opisthacanthus* (*Nepabellus*) *mossambicensis sp. n. (Figs. 1-17)

Type material. Mozambique, region nearby the village of Nhica do Rovuma, on the north-eastern portion of Mozambique close to the border with Tanzania, (I. Ineich leg), XII/2009. The scorpions were collected in a natural formation of dry forest, type Miombo, on sand soil. The scorpions were found under bark and inside rotten logs. Type material composed of 1 male holotype and 1 male and 1 female paratypes. The types will be deposited in the collections of the Muséum national d'Histoire naturelle, Paris, France.

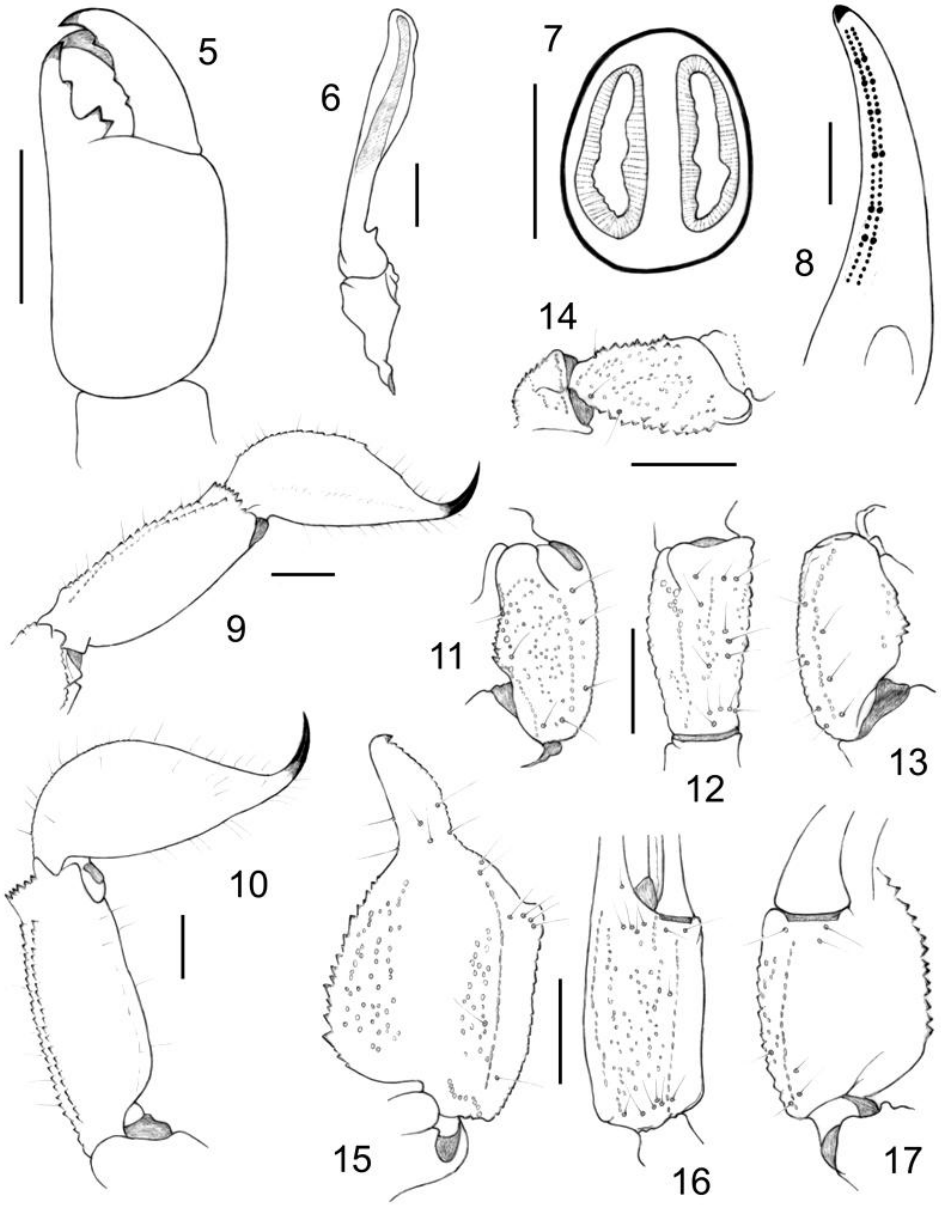
Etymology. The specific name makes reference to the country, Mozambique, where the new species was found.

Diagnosis. Scorpions of large size in relation to the species of the genus; male and female with respectively 69.8 and 74.9 mm in total length. Colouration reddish-yellow to reddish-brown, with darker zones over carinae and presence of blackish variegated zones on chelicerae. Pectines with 8-9 and 9-9 teeth in males and 9-9 teeth in female. Pedipalp fingers with two series of moderate granules separated by larger accessory granules. Hemispermatophore slender with a moderately elongated and weakly enlarged distal lamina; basal lamina short; global morphology rather simple. Genital operculum in male formed by two semi-oval plates, forming a global oval structure; genital operculum in females oval-shaped with a minute incision in the base. Tarsi of leg IV with 3-4 external and 2-3 internal spines. Trichobothrial pattern of type C orthobothriotaxy.

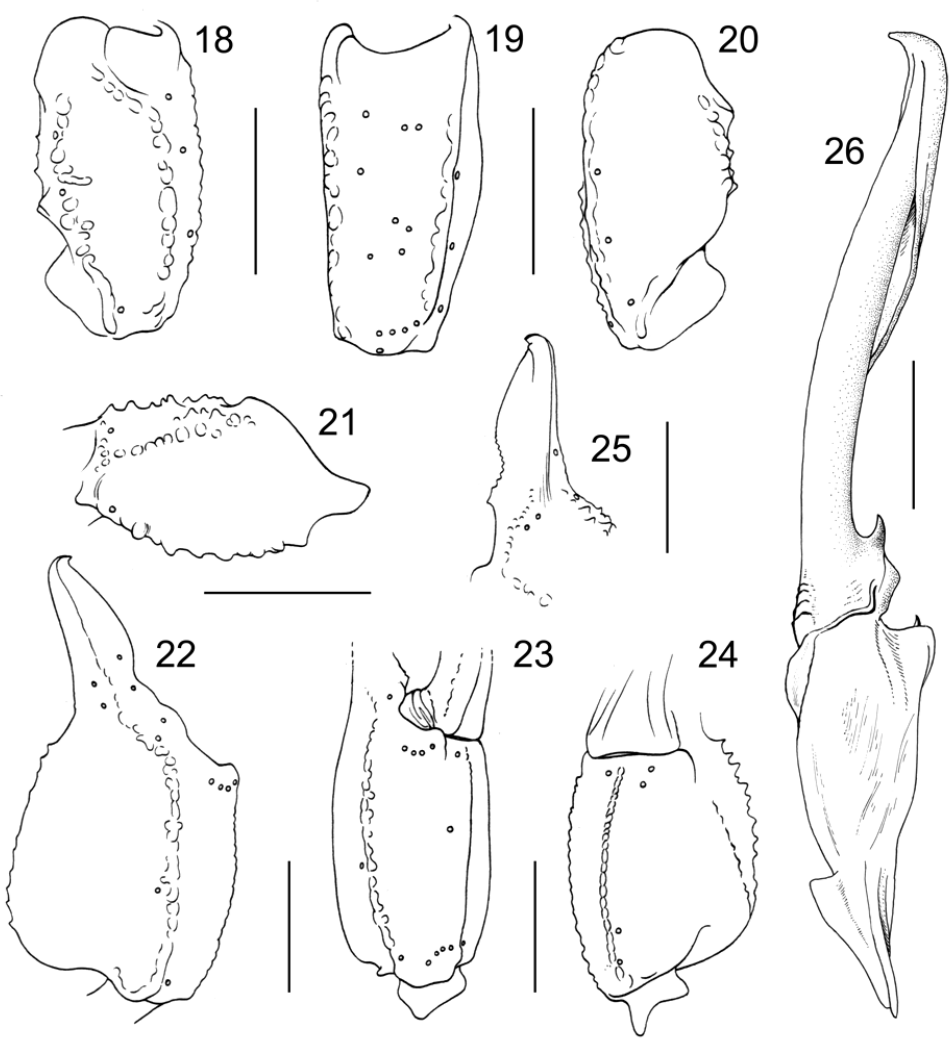
Description based on holotype and paratypes.

Colouration. Basically, reddish-yellow to reddish-brown with darker zones over carinae and some blackish variegated zones on chelicerae. Males globally darker than females.

Carapace reddish-yellow; median and lateral eyes surrounded with black pigment. Tergites reddish-brown. Metasomal segments reddish-brown to dark brown; vesicle yellow; aculeus dark reddish. Chelicerae reddish-brown; base of fingers darker; the whole surface with diffuse variegated spots; fingers yellowish-brown with dark red teeth. Pedipalps reddish to reddish-brown in males; yellow to yellowish-brown in females. most carinae blackish; chela fingers brown to blackish. Venter globally yellow; sternites reddish-yellow; pectines and genital operculum yellow, much paler than sternites; sternum and coxapophysis reddish-yellow; legs yellow.



Figs. 5-17. *Opisthacanthus* (*Nepabellus*) *mossambicensis* sp. n.
5,9,11-17. ♂ holotype. 6-7. ♂ paratype. 8,10. ♀ paratype. 5. Chelicera, dorsal aspect. 6. Hemispermatophore, external aspect. 7. Venom glands, transverse section. 8. Dentate margin of movable finger with rows of granules. 9-10. Metasomal segment V and telson, lateral aspect. 11-17. Trichobotrial pattern. 11-13. Patella, dorsal (11), external (12) and ventral (13) aspects. 14. Femur, dorsal aspect. 15-17. Chela, dorso-external (15), external (16) and ventral (17) aspects. (Scale bars: 2 mm except chelicera: 1 mm).



Figs. 18-26. Comparative material. 18-25. *Opisthacanthus* (*Nepabellus*) *rugiceps*, ♂ holotype, trichobotrial pattern. 18-20. Patella, dorsal (18), external (19), and ventral (20) aspects. 21. Femur, dorsal aspect. 22-24. Chela, dorso-external (22), external (23), and ventral (24) aspects. 25. Fixed finger, internal aspect. 26. *Opisthacanthus* (*Nepabellus*) *asper*, ♂, hemispermatophore, external aspect. (Scale bars: 2 mm).

Morphology. Carapace with moderate to strong granulations, better marked on male; presence of punctuations and smooth zones posteriorly; furrows moderately shallow. Anterior margin with a strong concavity reaching as far as the level of the 2nd lateral eye. Median ocular tubercle flattened and placed in the centre of the carapace, or even slightly posteriorly; median eyes moderate, separated by one ocular diameter or slightly more; three pairs of large lateral eyes. Sternum pentagonal, slightly wider than long. Genital operculum formed by two oval plates in male; in female composed of a single oval-shaped plate with a minute incision at the base. Tergites with a moderate to weak median carina, with small granulations and punctuations. Pectinal tooth count 8-9 and 9-9 in males, 9-9 in female. Sternites smooth and shiny; VII almost acarinate with very few punctuations. Metasomal segments I to V longer than wide, with some thin granulations in male and mainly punctuations in female. All carinae moderately marked in segments I-IV; segment V rounded with some spinoid granules on the ventral surface. All segments with moderate chaetotaxy. Telson with a pear-like shape; smooth and covered with strong

Figs. 27-28. Natural habitat of *Opisthacanthus* (*Nepabellus*) *mossambicensis* sp. n. nearby the village of Nhica do Rovuma, in north-eastern Mozambique, close to the border with Tanzania.

chaetotaxy. Pedipalps: femur with dorsal internal, dorsal external, ventral internal and ventral external carinae strong, tuberculate; dorsal face with strong granulations; ventral face with minute granulation; internal face moderately granulose. Patella with internal and external faces moderately granulated; dorsal strongly granulated; ventral face smooth; dorsal internal, ventral internal, ventral external and external carinae strong; other carinae less well marked. Chela moderately to strongly granular excepted on ventral face; dorsal marginal, external secondary, ventrointernal and ventral median carina

strong; other carinae less well marked. Chelicerae typical of Scorpionoidea (Vachon, 1963); teeth sharp but reduced. Trichobothriotaxy of type C, orthobothriotaxic (Vachon, 1974). Legs: tarsi with two lateral rows of spines; 3-4 external and 2-3 internal surrounded by a few long setae. Spurs moderate. Hemispermatophore slender with a moderately elongated and weakly enlarged distal lamina; basal lamina short; global morphology rather simple.

Relationships. The new species can be associated with the *asper* group (see Lourenço & Goodman, 2006; Lourenço *et al.*, 2018). It can however, be distinguished from the other species of this group and in particular from *Opisthacanthus asper* (Peters, 1861) and *Opisthacanthus rugiceps* Pocock, 1897 (Figs. 18-26) by a number of features: (i) a paler general colouration, more to yellow and reddish-yellow, (ii) a more intense granulation with marked spinoid granules on pedipalps, (iii) hemispermatophore with a quite simplified morphology, slender, and with a reduced basal lamella (iv) very simple venom glands, with a total absence of folds.

Morphometric values (in mm) of male and female paratypes. Total length (including telson) 69.8/74.9. Carapace: length 12.1/13.8; anterior width 7.6/8.2; posterior width 11.4/12.8. Mesosoma length 19.6/19.2. Metasomal segment I: length 4.7/5.3, width 3.6/4.0; II: length 4.9/5.4, width 3.1/3.7; III: length 5.3/5.9, width 2.8/3.6; IV: length 6.1/6.9, width 2.6/3.2; V: length 7.9/8.8, width 2.5/2.8, depth 2.9/3.2. Telson length 9.2/9.6. Vesicle: width 3.4/3.2, depth 2.9/3.4. Pedipalp: femur length 8.8/9.1, width 4.4/5.1; patella length 9.6/10.2, width 4.7/5.4; chela length 19.6/21.8, width 9.8/10.4, depth 6.4/6.8; movable finger length 10.5/12.4.

Fig. 29. Natural habitat of *Opisthacanthus* (*Nepabellus*) *rugiceps*, on the coast of Lake Malawi.

Ecology and Vegetation

Opisthacanthus rugiceps, was, a priori, originally collected in the region of Kota Kota on the south-western coast of Lake Nyasa, now Lake Malawi. However, Pocock himself (1898) stated that the precise locality should rather be in the east coast of Lake Nyasa and not Kota Kota as originally documented.

Today this east coast zone of the lake includes, in particular, some zones of a natural park which remains yet more or less preserved. Most other areas of the east coast of the lake have been largely deforested (Bootsma & Jorgensen, 2006).

Fig. 30. Map of south-eastern Africa, showing the approximate type localities of *Opisthacanthus* (*Nepabellus*) species belonging to the *asper* group: *O. asper* (1), *O. basutus* (2), *O. rugipes* (3; precise location unclear), and *O. mossambicensis* sp. n. (4).

The terrestrial areas of the park, except for the smallest islands, were once heavily wooded. Originally, this community comprised baobab *Adansonia digitata* and several species of *Ficus*, *Sterculia*, *Khaya*, and *Albizia*. The ground flora has not been studied in depth. Through clearing of the forest, many woodland areas have been altered to shrubby vegetation and cultivation. The upper slopes are dominated by mountain acacia *Brachystegia glaucescens* (Figs. 29-30).

In contrast, the habitat where is distributed the new species in Mozambique is composed of natural formation of dry forest, type Miombo, on sand soil (Figs. 27-30). The scorpions were found under bark and inside rotten logs. Some grains of sand can yet be observed sticked to the scorpions. According to the collector, our colleague Ivan Ineich from the Herpetology Dept. of the Muséum in Paris, the region is strongly marked by a very dry season which can last from 8 to 9 months while the rain season is limited to 3 or 4 months only. A few other species of scorpions were also collected in the same area, in particular a recently described species of *Iomachus* Pocock, 1893; namely *Iomachus* (*Africanoiomachus*) *ineichi* Lourenço, 2020 (Lourenço, 2020). Other genera also observed were *Pandinus* Thorell, 1876, *Uroplectes* Peters, 1861 and *Lychas* C.L. Koch, 1845.

Acknowledgments

We are most grateful to Dr Ivan Ineich (Muséum, Paris, France) for the permission to use the photos of the type locality of the new species.

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Description of a neotype of *Scorpio palmatus* (Ehrenberg, 1828) (Scorpiones: Scorpionidae)

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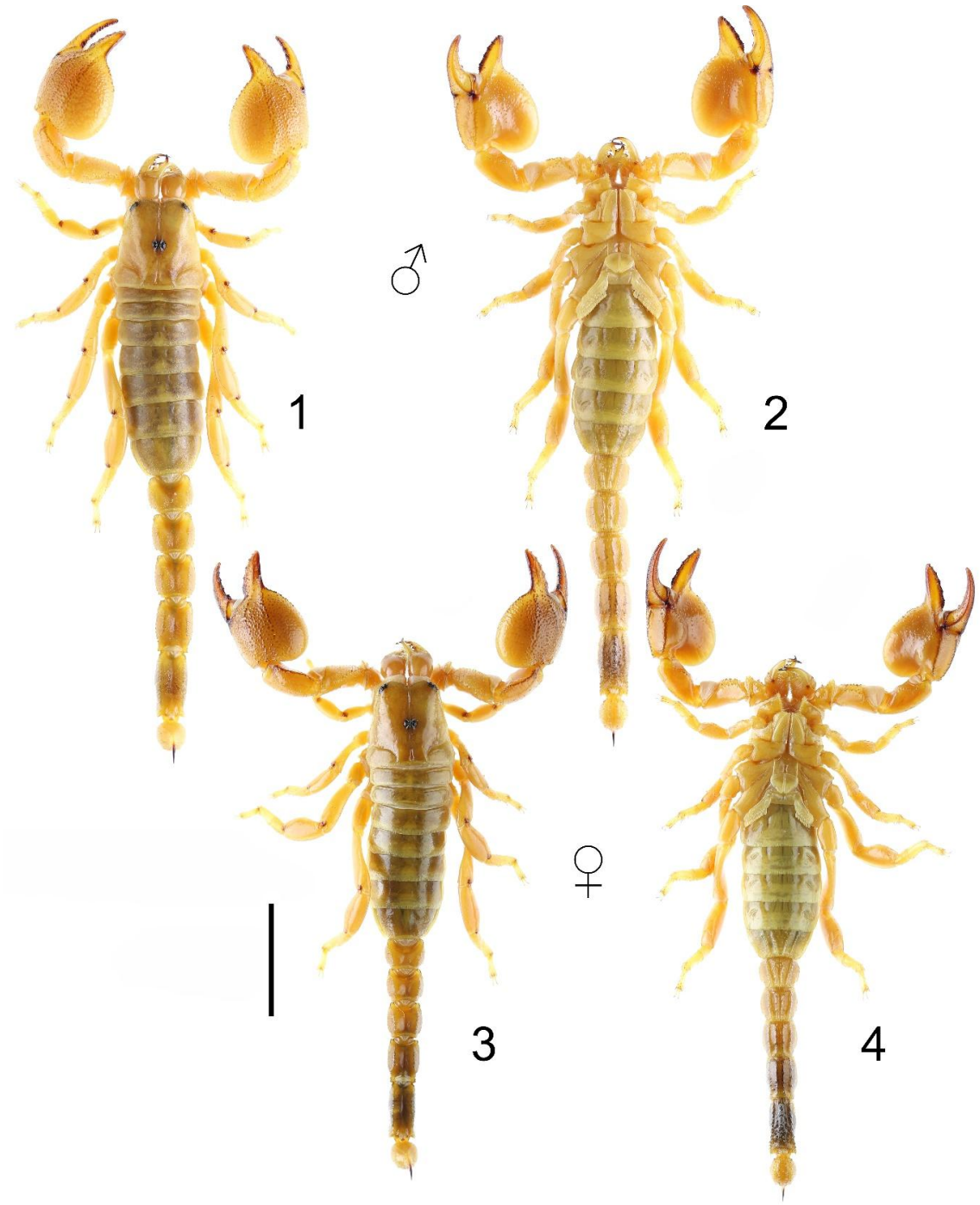
Abstract

Scorpio palmatus (Ehrenberg, 1828) is redescribed based on the male neotype and a female specimen from northern Egypt. Illustrations prepared under white and UV lights and measurements are given.

Keywords: Scorpionidae, *Scorpio palmatus*, neotype, Egypt.

Introduction

Scorpio palmatus was described as *Buthus* (*Heterometrus*) *palmatus* by Ehrenberg in Hemprich & Ehrenberg (1828). Ehrenberg in Hemprich & Ehrenberg (1828) did not publish an exact type locality, and reported this species from "Libyan desert" (?Egypt), Egypt (Alexandria, Sinai), Lebanon (mountains), "Arabia", and "Syria". Next year, Ehrenberg in Hemprich & Ehrenberg (1829) described two more subspecies, *Buthus* (*Heterometrus*) *palmatus flavus* from Egypt (Alexandria, Libyan desert) and *B.* (*H.*) *palmatus rufus* from Egypt (Sinai); Pocock (1900) synonymized both of these taxa with *Heterometrus palmatus* Ehrenberg, 1829. Birula (1898) treated this species as *Heterometrus palmatus* but then (Birula, 1900) transferred it to the genus *Scorpio* as *S. palmatus*. However, later Birula (1909, 1910) treated it as a subspecies of *Scorpio maurus*. A century later, Talal *et al.* (2015) re-evaluated this taxon and elevated it again to species level. However, Talal *et al.* (2015) used only molecular data and gave very little morphological information on this species.

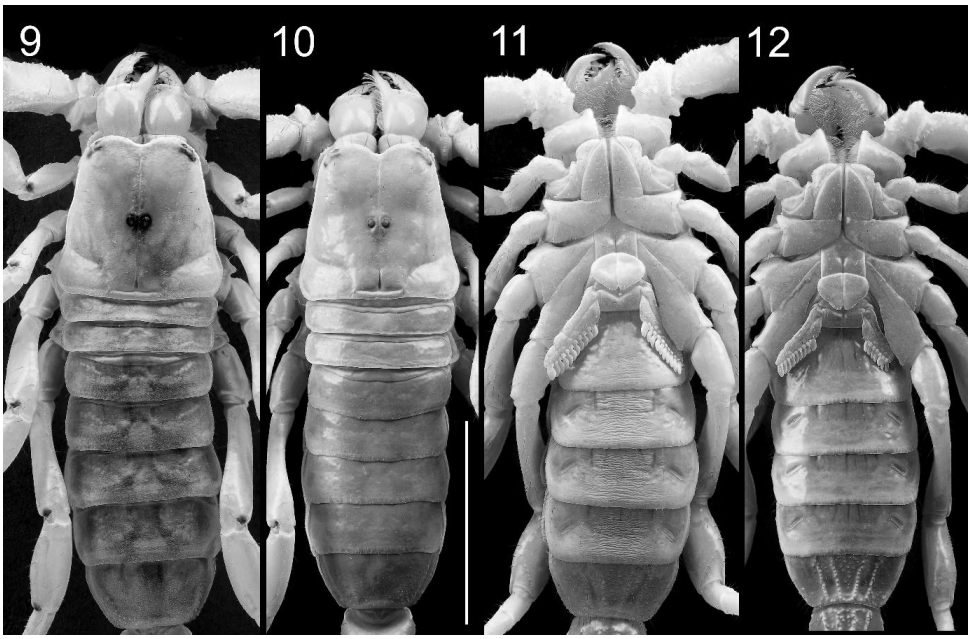


Figs. 1-4. *Scorpio palmatus* (Ehrenberg, 1828), habitus. 1-2. Male neotype. 3-4. Female from Matruh, northern Egypt. 1,3. Dorsal view. 2,4. Ventral view. (Scale bar: 10 mm).

Scorpio palmatus has been reported from Algeria (Lucas, 1849; Pallary, 1929, 1934; El-Hennawy, 1992), Egypt (Including Sinai) (Ehrenberg in Hemprich & Ehrenberg, 1828, 1829; Pocock, 1900; Simon, 1910; Birula, 1908, 1910; Gough & Hirst, 1927; Vachon, 1966; Levy & Amitai, 1980; El-Hennawy, 1992; Talal *et al.*, 2015; Khammassi *et al.*, 2024; Abu Afifeh *et al.*, 2024), Palestine/Israel (Gough & Hirst, 1927; Vachon, 1966; Levy & Amitai, 1980; El-Hennawy, 1992; Talal *et al.*, 2015; Khammassi *et al.*, 2024), Jordan (Levy & Amitai, 1980; Kinzelbach, 1984; Wahbeh, 1976; El-Hennawy, 1988; Amr *et al.*, 1988; Amr & Abu Baker, 2004; El-Hennawy, 1992; Amr & Al-Oran, 1994), Lebanon (Ehrenberg in Hemprich & Ehrenberg, 1828; Levy & Amitai,

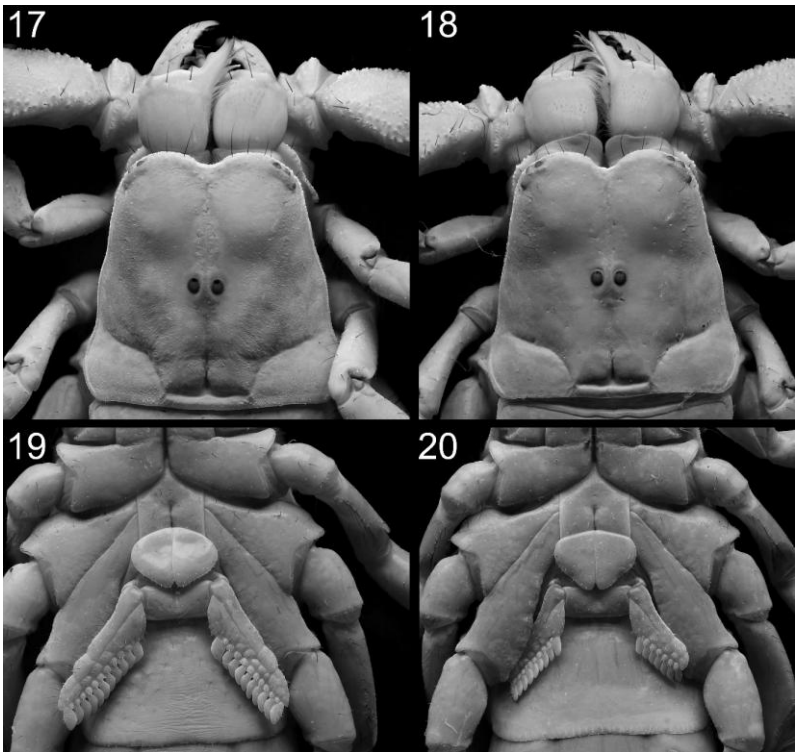
1980), Libya (Ehrenberg in Hemprich & Ehrenberg, 1828, 1829; Levy & Amitai, 1980; El-Hennawy, 1992), and Syria (Kabakibi *et al.*, 1999). Abu Afifeh *et al.* (2024) reviewed *Scorpio* populations of Jordan and described as a new species *S. jordanensis* the populations earlier reported as *S. palmatus*; this species was thus removed from the fauna of Jordan.

Figs. 5-8. *Scorpio palmatus* (Ehrenberg, 1828), under white light. 5,7. Male neotype. 6,8. Female from Matruh, northern Egypt. 5-6. Carapace and mesosoma. 7-8. Sternopectinal area and mesosoma ventral. (Scale bar: 10 mm).



Figs. 9-12. *Scorpio palmatus* (Ehrenberg, 1828), under UV light. 9,11. Male neotype. 10,12. Female from Matruh, northern Egypt. 9-10. Carapace and mesosoma. 11-12. Sternopectinal area and mesosoma ventral. (Scale bar: 10 mm).

Figs. 13-16. *Scorpio palmatus* (Ehrenberg, 1828), under white light. 13,15. Male neotype. 14,16. Female from Matruh, northern Egypt. 13-14. Carapace. 15-16. Coxal and sternopectinal region.



Figs. 17-20. *Scorpio palmatus* (Ehrenberg, 1828), under UV light. 17,19. Male neotype. 18,20. Female from Matruh, northern Egypt. 17-18. Carapace. 19-20. Coxal and sternopectinal region.

To provide systematic stability of *Scorpio palmatus*, Abu Afifeh *et al.* (2024) designated a neotype of this species from Alexandria (Egypt) and presented a detailed redescription of this species including intraspecific variation. However, Abu Afifeh *et al.* (2024) did not provide a description of the neotype they designated, instead using other material from Egypt for redescription of *Scorpio palmatus*. Here, we report the morphology of the male neotype as well as a female from Egypt.

Material and Methods

Photographs were taken by Canon EOS 7D. Stacking of pictures was made using Helicon Focus software. The focus stacking method is modified from Canon-Cognisys system described in Brecko *et al.* (2014). Illustration under UV illumination was after Volschenk (2005). The trichobothrial nomenclature was followed according to Vachon (1974) and morphological nomenclature was after Stahnke (1970), Francke (1977), Hjelle (1990), and Soleglad & Sissom (2001).

Results

Family **Scorpionidae** Latreille, 1802
Genus ***Scorpio*** Linnaeus, 1758
Scorpio palmatus (Ehrenberg, 1828)
Figs. 1-61, Table 1

Selected references:
Buthus (*Heterometrus*) *maurus palmatus*: Hemprich & Ehrenberg, 1828: pl. I, fig. 1.
Heterometrus palmatus: Birula, 1898: 134-135.
Scorpio palmatus: Birula, 1900: 13-14; Birula, 1908: 147-148.
Scorpio maurus palmatus: Birula, 1909: 517-518; Birula, 1910: 166-169, pl. XI, fig. 8; pl. XII, fig. 7; Fet, 2000: 478 (complete references list until 1999).

Material examined: Neotype, ♂: **Egypt,** *Alexandria Province*, Borg El Arab, Bahig, West of Bahig village, 1 September 2001 (AZMM/Sco-2001:1); *Matruh Province*, Mersa Matruh, 1♂, 1♀, 20.09.2021, leg. A. Badry (AZMM/Sco-2021:162-163).

Description: Based on male neotype. Measurements are in Table (1).

Colouration (Figs. 1-2): Carapace brilliant yellow, central and anterior areas light reddish yellow patches with reddish yellow reticulations. Tergites I-VI light yellowish brown with yellowish brown reticulations and brownish yellow marblings; yellow patches medially and yellow bands at posterior margins exist. Tergite VII light brownish yellow. Coxae and sternum dark yellow. Genital operculum and pectines brilliant light yellow. Sternites III-VI brilliant light olive yellow at anterior portion and brilliant yellow at posterior portion. Sternite VII dark yellow. Pedipalp femur and patella dark yellow, carinae and granules light reddish yellow. Chela manus light yellow, external surface light reddish yellow reticulation in the middle area and granules and carinae reddish yellow, internal surface light reddish yellow in the middle area. Fixed finger yellow, dorsal margin and anterior tip reddish yellow, dental margin red, granules black. Movable finger yellow, anterior tip reddish yellow, dental margin red and granules black. Metasoma I-IV uniformly yellow, only ventral submedian and ventrolateral carinae of segment VI fuscous. Segment V brownish with fuscous carinae. Telson yellow, aculeus reddish at the base and black at the tip. Legs: Tarsi, basitarsus and pretarsus light yellow, femur and tibia lustrous and yellow. Spinules and condyles reddish brown. Chelicera

manus lustrous and dark yellow with light brown reticulations anteriorly. Chelicera fingers yellow, tips of fingers and teeth red to black.

Table 1. Comparative measurements of *Scorpio palmatus* male neotype and a female from Egypt. Abbreviations: length (L), width (W), width anterior (Wa), width posterior (Wp), depth (D).

Measurements (mm)		***Scorpio palmatus*** ♂, Neotype	***Scorpio palmatus*** ♀
Carapace	L / Wa / Wp	7.76 / 5.14 / 7.76	7.44 / 5.30 / 7.39
Mesosoma	L	15.49	14.60
Tergite VII	L / W	4.40 / 5.43	2.58 / 5.78
Metasoma + telson	L	26.20	22.45
Segment I	L / W / D	2.94 / 3.98 / 2.94	2.61 / 3.49 / 2.66
Segment II	L / W / D	3.38 / 3.67 / 3.08	2.77 / 3.20 / 2.51
Segment III	L / W / D	3.80 / 3.50 / 3.24	3.06 / 2.99 / 2.57
Segment IV	L / W / D	4.52 / 3.24 / 3.07	3.73 / 2.63 / 2.39
Segment V	L / W / D	5.57 / 2.89 / 2.71	5.25 / 2.24 / 2.12
Telson	L / W / D	5.99 / 2.70 / 2.25	5.03 / 2.43 / 2.05
Pedipalp	L	20.44	20.69
Femur	L / W	4.94 / 2.29	5.59 / 2.20
Patella	L / W	5.11 / 2.79	5.00 / 2.11
Chela	L	10.39	10.10
Manus	L / W / D	7.42 / 7.09 / 3.92	6.72 / 6.15 / 3.45
Total	**L**	**44.49**	**47.92**

Carapace (Figs. 5,9,13,17): Carapace is slightly longer than wide; almost upright trapezoid in shape. Carapace anterior edge distinctly bilobed with a deep median indentation. Anterior margin rough to bumpy with 10 medium or large setae. Carapace lacks carinae, only smooth posteriomedian carinae slightly visible. Carapace shagreened with a triangular region between median eyes and anterior margin smooth and lateral eyes. Anteriomedian furrow shallow and narrow with dense small granules along it. Median ocular tubercle shallow and located in the centre of the carapace. A pair of median eyes and three pairs of lateral eyes exist; the third located separately and slightly smaller. The posteriomedian furrow is wide and bifurcated as an inverted T-shaped at posterior edge and located in arrow-shaped depressions between posteriomedian carinae and posterior margin. Posterior lateral furrows wide and distinct. A few setae on the anterior area of carapace and a couple setae behind of median eyes exist.

Pectines (Figs. 15,19): Pectines short, teeth numbers 11–11 (First and second teeth fused at right pecten); three marginal and four and five median lamellae. Stigmas linear, angled 45° and conspicuous.

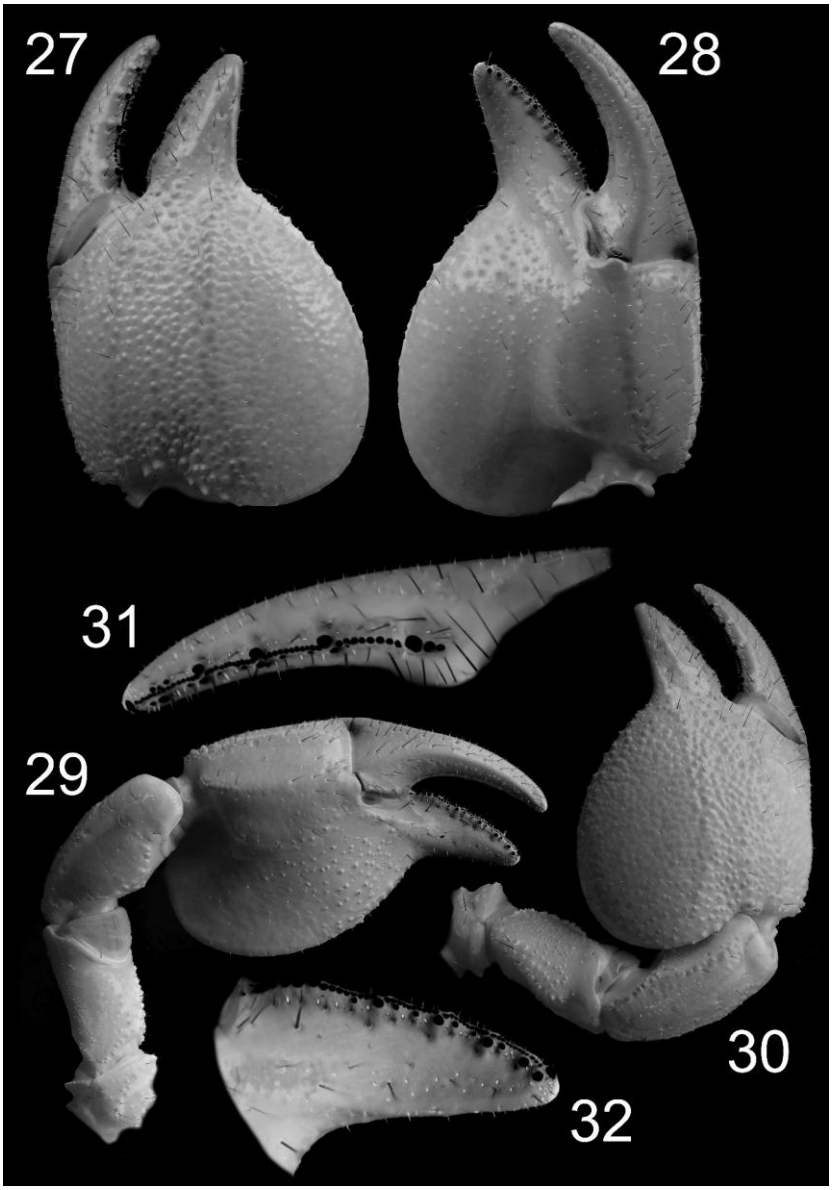
Chelicerae (Figs. 13,17): Cheliceral dentition characteristic for the family of Scorpionidae (Vachon, 1963); subdistal tooth and basal teeth conspicuous rather than on the movable finger. No longitudinal ridges present anteriorly.

Pedipalp (Figs. 21-32): Pedipalp femur with three carinae; dorsointernal and ventrointernal carinae moderate with spaced rounded granules; dorsoexternal carinae rounded with separated, large and rounded granules. Dorsal and ventral intercarinal area shagreened with moderate sized granules. Intercarinal surface with a few distinct setae.

Figs. 21-26. *Scorpio palmatus* (Ehrenberg, 1828), pedipalp segments of male neotype, under white light. 21-22. Chela dorsal (21) and ventral (22). 23-24. Pedipalp ventral (23) and dorsal (24). 25. Movable finger dentition. 26. Fixed finger dentition.

Patella with two carinae; dorsomedian carina strong with so flattened and fused granules; ventrointernal carinae rounded with a few flattened and rounded granules. Dorsal and ventral intercarinal area smooth; external intercarinal area smooth with distinct rounded granules; internal surface shagreened. All intercarinal surfaces with scattered distinct setae. The external surface of chela manus with large and flattened granules, the granules are more distinct and rounded in the anterior area and on the ventral edge side, the granules gradually flattened posteriorly and towards the ventral edge, the posterior area and ventral margin side were almost smooth. Posterior margin of external surface with a few large, spinoid granules. Internal surface of chela manus smooth with moderate pointed granules on anterior portion. Digital carina and external secondary carinae indistinct, but bears large, flattened, and rounded granules; the size of the granules gradually increases anteriorly and the carinae come closer to each other. Ventroexternal and ventrointernal carinae strong, obsolete without granules but bumpy. Chela manus

flattened, slightly longer than wide. Chela fingers are relatively short without granules. Fixed and movable fingers with 5 strong accessory denticles. Intercarinal surface with few distinct setae in manus, but fingers with more dense setae. Trichobothriotaxy of type C; orthobothriotaxic (Vachon, 1974).



Figs. 27-32. *Scorpio palmatus* (Ehrenberg, 1828), pedipalp segments of male neotype, under UV light. 27-28. Chela dorsal (27) and ventral (28). 29-30. Pedipalp ventral (29) and dorsal (30). 31. Movable finger dentition. 32. Fixed finger dentition.

Mesosoma (Figs. 5,7,9,11): Tergites I-VII acarinate. Tergites I-VI matt and shagreened with scattered small granules. Tergite VII shagreened with scattered medium sized granules. Sternites III-VI smooth and wrinkled with scattered setae. Sternite VII granular between lateral carinae with four granular carinae, granules medium sized and fused. Genital operculum ovoidal, a small posterior indentation exists between sclerites.
Metasoma and telson (Figs. 45,47,49,51,53,55,57-60): Metasoma I-II wider than long, III-V longer than wide. Metasoma I with 10, II-IV with 8, and V with 7 carinae. Lateral inframedian carinae on segment I indistinct, composed by a few spaced rounded granules

at anterior portion. Ventral submedian carinae and not granular, rough to bumpy on segments I-II, moderate and obsolete on segments III-IV. Ventrolateral carinae strong, not granular, rough to bumpy on segments I-II, strong and obsolete on segments III-IV. Dorsolateral carinae strong and crenulated with small, spaced spinoid granules on segments I-IV. Lateral supramedian carinae moderate with weak, spaced granules on segments I-IV. Intercarinal area smooth, covered with moderately medium and small sized granules on lateral surfaces, on segments I-IV; nearly smooth on ventral surfaces on segments I-IV, only 3-4 small granules exist between ventral submedian carinae on segment I; dorsal surfaces densely granular with small and medium sized granules on segments I-V. Segment V: Ventromedian carina moderate with large, spinoid and pointed granules; ventrolateral carinae strong and serrated with spaced large, conical and pointed granules, size of granules increase gradually posteriorly, continues in lateral of anal arch;

Figs. 33-38. *Scorpio palmatus* (Ehrenberg, 1828), pedipalp segments of female from Matruh, northern Egypt, under white light. 33-34. Chela dorsal (33) and ventral (34). 35-36. Pedipalp ventral (35) and dorsal (36). 37. Movable finger dentition. 38. Fixed finger dentition.

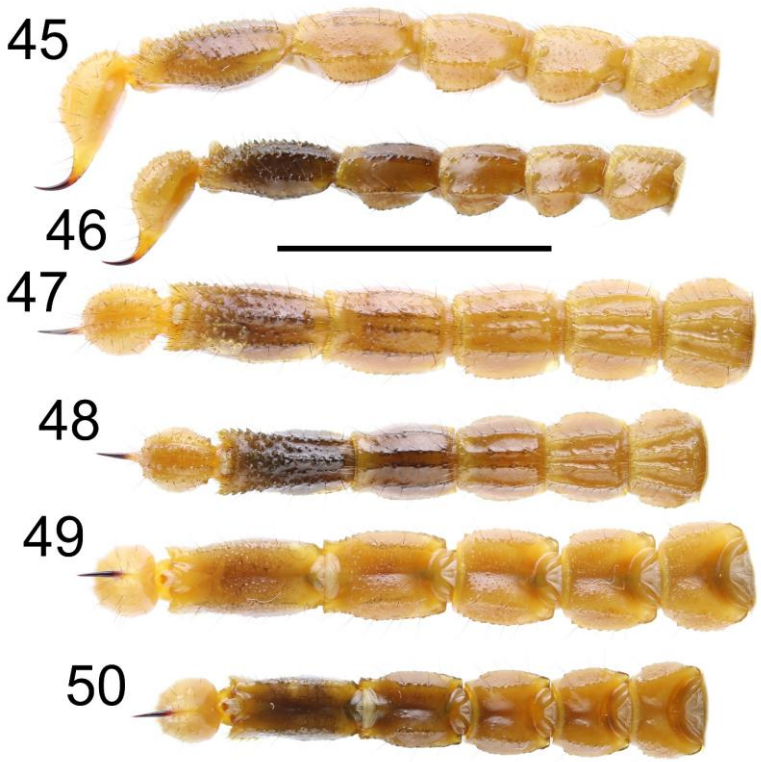
Figs. 39-44. *Scorpio palmatus* (Ehrenberg, 1828), pedipalp segments of female from Matruh, northern Egypt, under UV light. 39-40. Chela dorsal (39) and ventral (40). 41-42. Pedipalp ventral (41) and dorsal (42). 43. Movable finger dentition. 44. Fixed finger dentition.

dorsolateral carinae moderate and rounded with moderate and pointed granules; lateral inframedian carinae exist on posterior portion with fine, spaced granules. Lateral surfaces with moderately dense medium sized granules, ventral surface densely covered with large and conical granules, dorsal surfaces densely granular with small and medium sized granules. Ventral of anal arch serrated with pointed granules. Ventral and lateral surfaces moderately covered with variable sized setae in segments I-V.

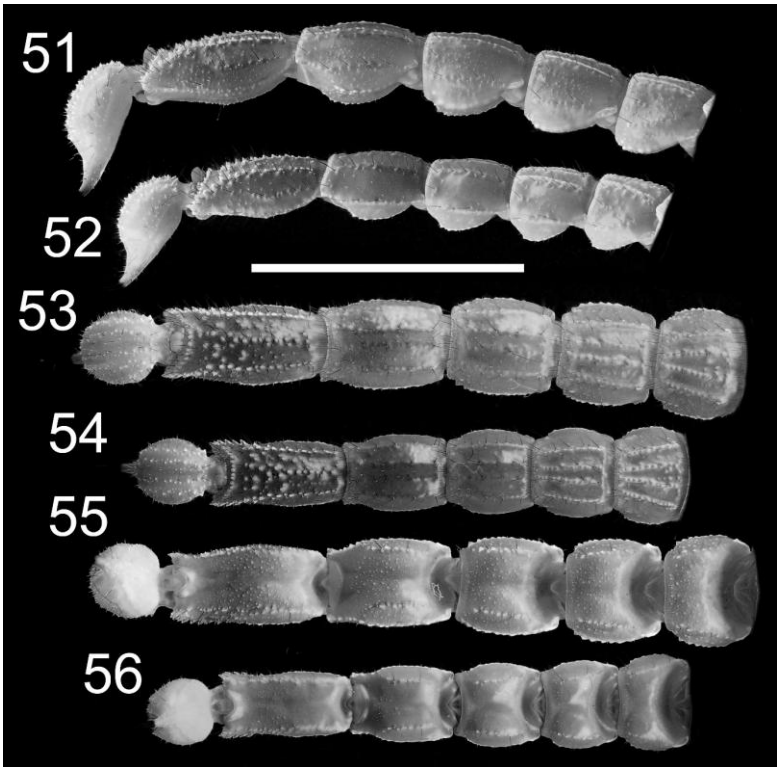
Vesicle globular and slightly elongated, surface smooth; granulated ventrally with spinoid granules. Vesicle with numerous macrosetae reaching the base of aculeus. Aculeus strongly curved and shorter than vesicle.

Legs (Fig. 61): Coxa and trochanters smooth. Tarsi of right legs I to IV with 4/8 - 4/8, 5/8 - 5/8, 6/9 - 6/10, 6/9 - 7/9 internal and external spines arranged in series. Basitarsus of legs I with 2-2 retrolateral spines and on legs II with 3- retrolateral spines.

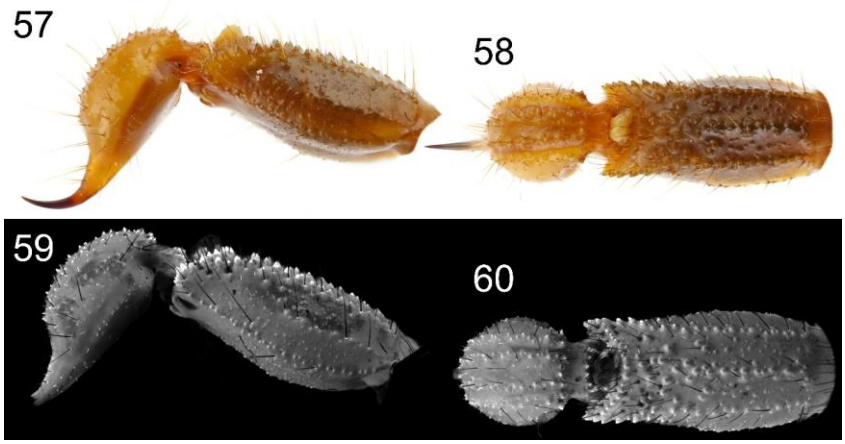
Measurements: See Table (1).



Figs. 45-50. *Scorpio palmatus* (Ehrenberg, 1828), metasoma and telson, under white light. 45,47,49. Male neotype. 46,48,50. Female from Matruh, northern Egypt. 45-46. Lateral view. 47-48. Ventral view. 49-50. Dorsal view. (Scale bar: 10 mm).



Figs. 51-56. *Scorpio palmatus* (Ehrenberg, 1828), metasoma and telson, under UV light. 51,53,55. Male neotype. 52,54,56. Female from Matruh, northern Egypt. 51-52. Lateral view. 53-54. Ventral view. 55-56. Dorsal view. (Scale bar: 10 mm).



Figs. 57-60. *Scorpio palmatus* (Ehrenberg, 1828), male neotype, metasoma V and telson. 57,59. Lateral view. 58,60. Ventral view. 57-58. Under white light. 59-60. Under UV light.

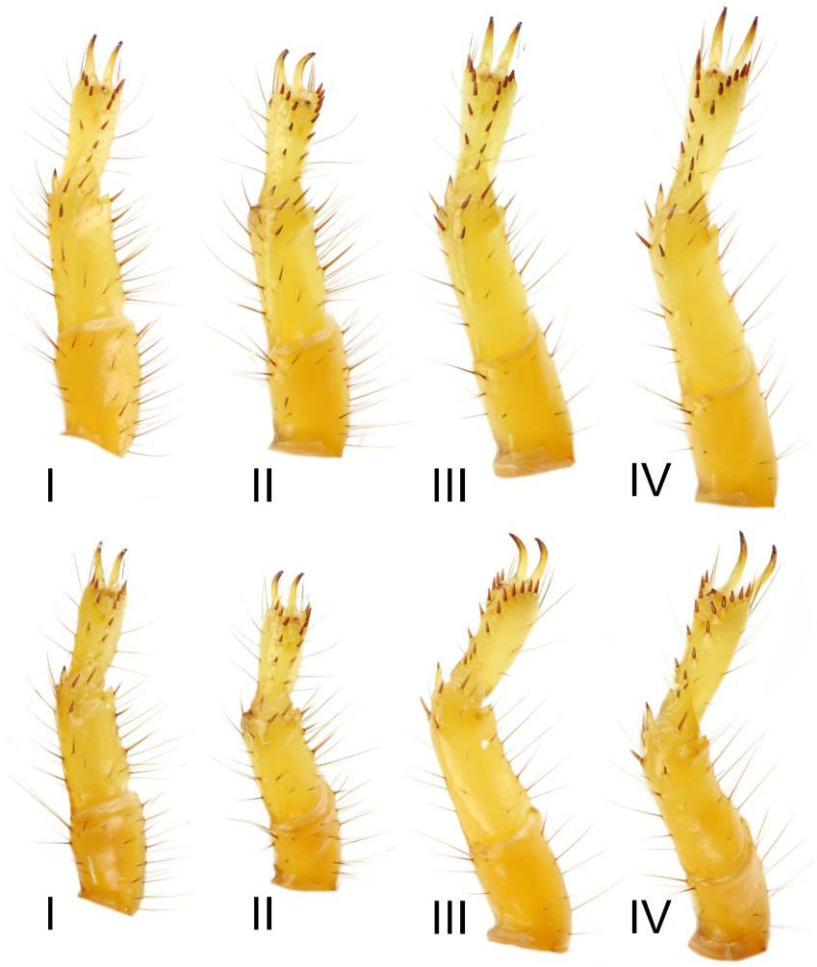


Fig. 61. *Scorpio palmatus* (Ehrenberg, 1828), right legs I-IV of male neotype (top) and female from Matruh, northern Egypt (bottom).

Discussion

Numerous populations of *Scorpio* have been identified as *Scorpio palmatus* in the Middle East and North Africa (Fet, 2000). However, some of these populations may be

misidentified and include new species. For instance, Abu Afifeh *et al.* (2024) reviewed some populations in Jordan that were formerly identified as *S. palmatus* and identified thisese populations as new species *S. jordanensis.* Abu Afifeh *et al.* (2024) designated a neotype for *S. palmatus* and gave a detailed redescription of this species from Egypt; however, this redescription was not based on the neotype. To determine the true identities of *S. palmatus* as well as some populations reported under *S. maurus* Linnaeus, 1758, it is very important to know the exact morphology of *S. palmatus*. Therefore, the morphology of the neotype specimen is given in this study as well as a female from a close locality.

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Serket (2024) vol. 20(3): 230-235.

First record of *Scorpio jordanensis* from Syria (Scorpiones: Scorpionidae)

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Abstract

Scorpio jordanensis Abu Afifeh *et al.*, 2024 is recently described from Jordan. Now, it is recorded from Syria. Its illustrations and measurements are given.

Keywords: Scorpionidae, *Scorpio jordanensis*, Syria, distribution.

Introduction

Scorpio jordanensis Abu Afifeh, Yağmur, Al-Saraireh & Amr, 2024 was recently described by Abu Afifeh *et al.* (2024) from Jordan. Abu Afifeh *et al.* (2024) reviewed *Scorpio* populations of Jordan including some populations that were reported as *Scorpio palmatus* (Ehrenberg, 1828) or *Scorpio kruglovi* Birula, 1910. They excluded these species from the fauna of Jordan and described these populations as *Scorpio jordanensis*.

The first record of *S. palmatus* from Syria (Damascus) was given by Kabakibi *et al.* (1999) as *Scorpio maurus palmatus*. After this record, existence of *Scorpio palmatus* has not been confirmed again from Syria.

One female of specimen series of Kabakibi *et al.* (1999) is examined in this study and identified as *S. jordanensis* Abu Afifeh *et al.*, 2024 which is recently described from Jordan.

Figs. 1-2. *Scorpio jordanensis* Abu Afifeh *et al.* (2024), habitus. Female from Damascus, Syria. 1. Dorsal view. 2. Ventral view. (Scale bar: 10 mm).

Material and Methods

Photographs were taken by Canon EOS 7D and pictures were stacked using Helicon Focus software. The focus stacking method is modified from Canon-Cognisys system described in Brecko *et al.* (2014). The trichobothrial nomenclature was followed according to Vachon (1974) and morphological nomenclature was after Stahnke (1970), Francke (1977), Hjelle (1990), and Soleglad & Sissom (2001).

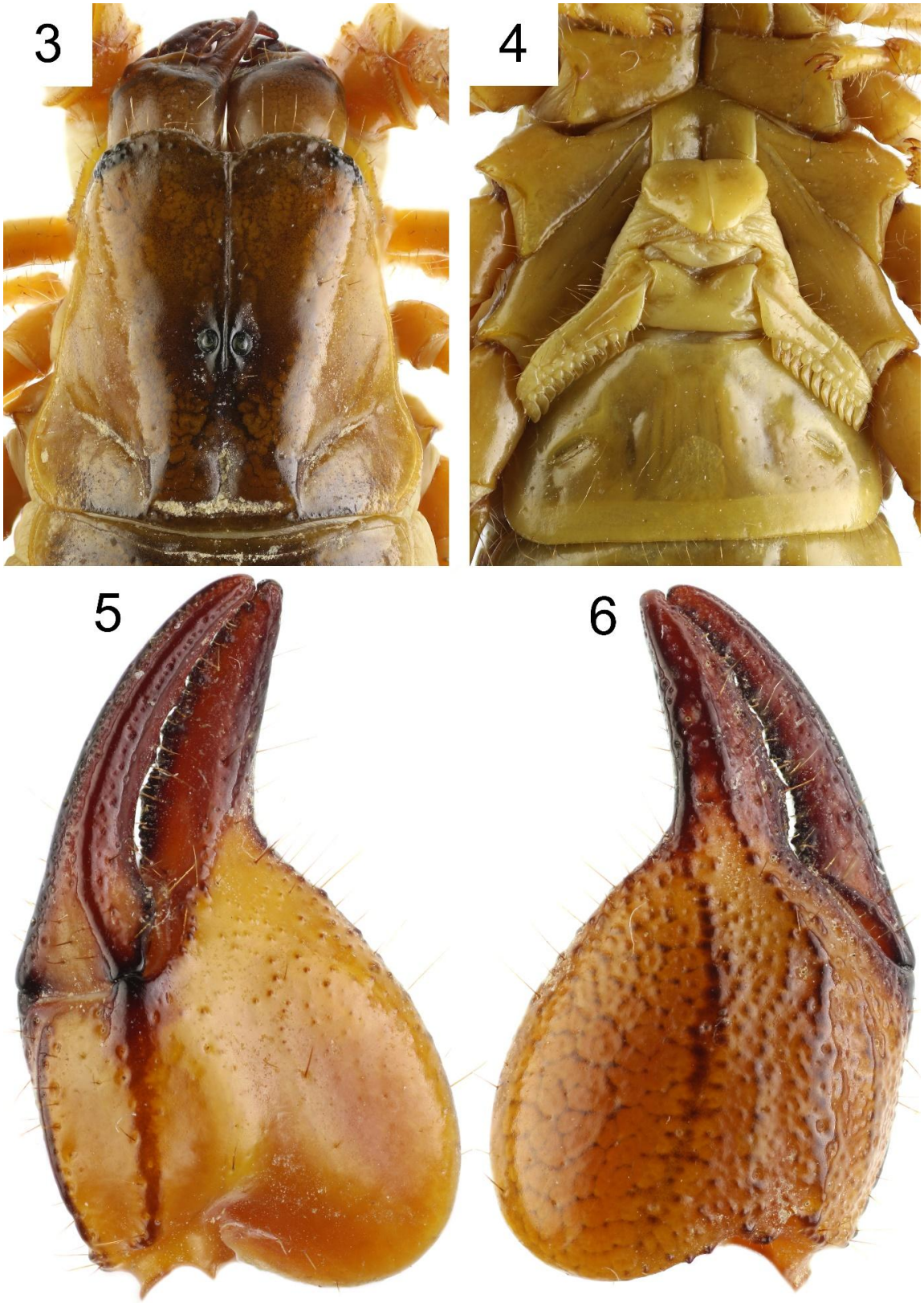
Results

Family **Scorpionidae** Latreille, 1802
Genus ***Scorpio*** Linnaeus, 1758
Scorpio jordanensis Abu Afifeh, Yağmur, Al-Saraireh & Amr, 2024
Figs. 1-10, Table 1

References:
Scorpio palmatus: Kabakibi *et al.*, 1999: 86-88, fig. 9.
Scorpio jordanensis: Abu Afifeh *et al.*, 2024: 24-37, figs. 2, 8, 145-214, 216, 218, 220, 222, 362, 368, 371.

Material examined: Syria, Damascus, Al-Sabe' Biyar (as As'sabee Byar), 1♀, June 1996, leg. N. Khalil (AZMM/Sco-1996:1).

Diagnosis: Total length 55.58 mm. Carapace and mesosoma brownish yellow, brown reticulations medially. Sternites dark yellow. Metasoma and telson dark yellow; fifth segment and ventral submedian carinae of segments III-IV fuscous. Pedipalp femur and patella dark yellow. Internal surface of chela reddish yellow. External surface of chela yellowish red, chela carinae and fingers reddish black. Carapace is slightly longer than wide; almost trapezoid in shape. Carapace anterior margin distinctly bilobed with a deep



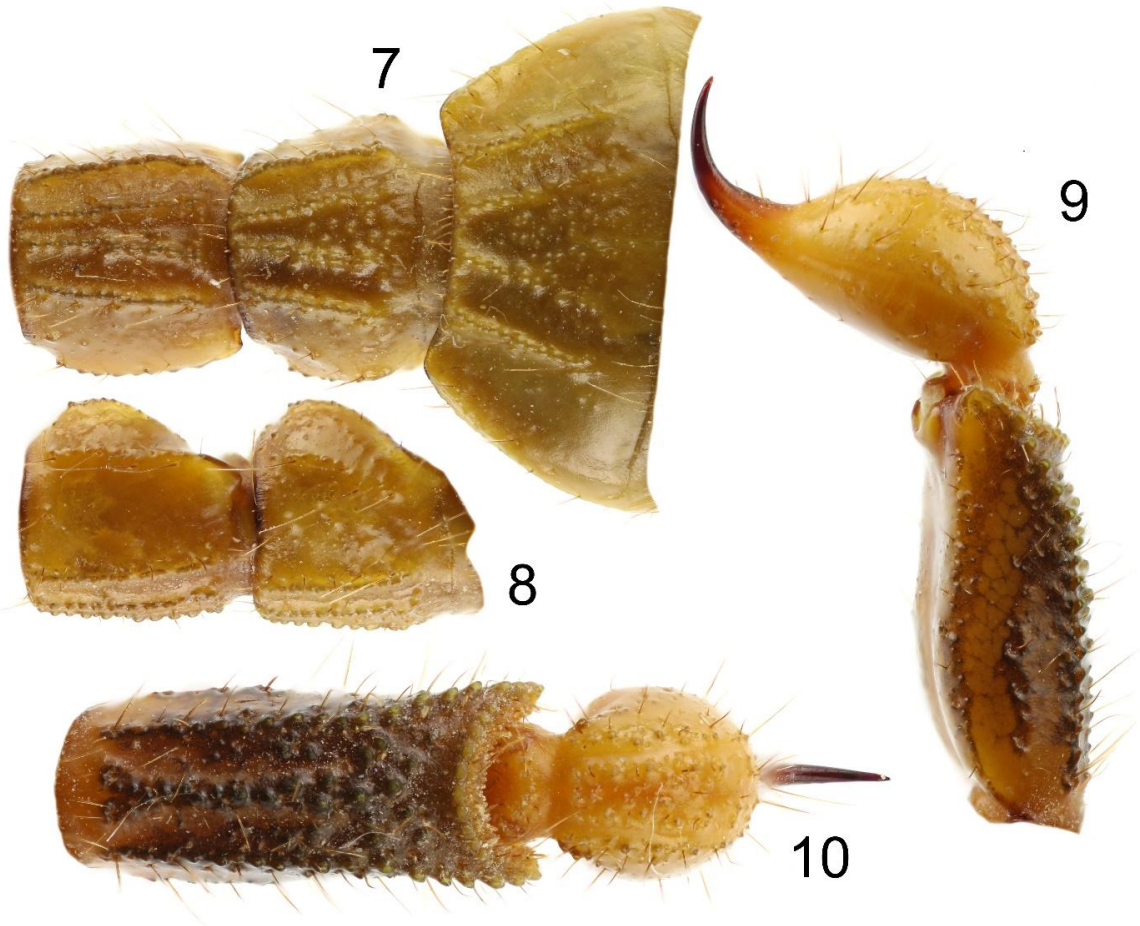
Figs. 3-6. *Scorpio jordanensis* Abu Afifeh *et al.* (2024), female from Damascus, Syria. 3. Carapace. 4. Coxal and sternopectinal region. 5. Chela, dorsal view. 6. Chela, ventral view.

median indentation. Carapace lacks carinae, only posteriomedian carinae slightly visible. Carapace shagreened but a triangular region between median eyes and anterior margin smooth. Tergites I-VI acarinate, smooth, lustrous; post-tergites of segments I-IV with flattened moderate granules, tergite VII acarinate, moderately covered with dense coarse and pointed granules. Sternites III-VI smooth and lustrous. Sternite VII with four granular carinae, the area between lateral carinae granulars. Pectines short; teeth number 10-10. Metasoma I with 10, II-IV with 8, and V with 7 carinae. Metasoma I-II wider than long, segments III-V longer than wide. Ventral submedian carinae and ventrolateral carinae strong with moderate, spaced and rounded granules on segments I-II, strong and obsolete granules on segments III-IV. Between ventral submedian carinae of segment I with small to medium granules. Dorsolateral carinae moderate and rounded with spinoid granules on segment V. Vesicle globular and smooth. Pedipalp femur with three carinae, patella with two carinae. The external surface of chela manus with very large and very flattened granules, more distinct and rounded in anterior area, posterior part with smaller granules. Internal surface smooth with scattered conical granules in anterior portion. Posterior margin of external surface, and internal margin with large and conical granules. Digital carina not distinct but with larger and more distinct and fused granules than other granules; external secondary carina distinct with large and fused granules, that get denser anteriorly. Chela manus flattened, slightly longer than wide. Fixed and movable fingers with 4 or 5 strong accessory denticles. Intercarinal surface with few distinct setae on manus. Trichobothriotaxy of type C; orthobothriotaxic (Vachon, 1974).

Measurements: See Table (1).

Table 1. Measurements of *Scorpio jordanensis* female from Syria. Abbreviations: length (L), width (W), width anterior (Wa), width posterior (Wp), depth (D).

Measurements (mm)	***Scorpio jordanensis*** ♀	
Carapace	L / Wa / Wp	8.11 / 5.36 / 8.01
Mesosoma	L	20.7
Tergite VII	L / W	4.41/ 6.99
Metasoma + telson	L	26.77
Segment I	L / W / D	2.96 / 4.16 / 3.54
Segment II	L / W / D	3.23 / 3.70 / 3.28
Segment III	L / W / D	3.87 / 3.46 / 2.99
Segment IV	L / W / D	4.65 / 3.15 / 2.81
Segment V	L / W / D	6.33/ 2.64 / 2.32
Telson	L / W / D	5.73 / 2.61 / 2.30
Pedipalp	L	21.9
Femur	L / W	4.86 / 2.35
Patella	L / W	5.45 / 2.48
Chela	L	11.59
Manus	L / W / D	6.90 / 6.64 / 3.76
Movable finger	L	7.73
Total	**L**	**55.58**



Figs. 7-10. *Scorpio jordanensis* Abu Afifeh *et al.* (2024), female from Damascus, Syria. 7. Seventh sternite and metasomal segments I-II, ventral view. 8. Metasomal segments I-II, lateral view. 9-10. Metasoma V and telson, lateral (9) and ventral (10) views.

Discussion

According to Abu Afifeh *et al.* (2024) seventh sternite and ventral surface of segment I moderately granular in *S. jordanensis* whereas in *S. palmatus* it has a few scattered granules and ventrolateral and ventral submedian carinae of segments I and II with spaced distinct rounded granules in *S. jordanensis*, whereas indistinct and fused granules are present in *S. palmatus*. Besides Abu Afifeh *et al.* (2024) reported that *S. jordanensis* has variations in colouration and morphology. We examined a female specimen belonging to the population was detected as *S. palmatus* from Syrian by Kabakibi *et al.* (1999) and compared in term of Abu Afifeh *et al.* (2024) informed characters. We concluded that specimen from Damascus (Syria) fits to *S. jordanensis* in terms of determined characters by Abu Afifeh *et al.* (2024). With this study *S. jordanensis* is reported for scorpion fauna of Syria in place of *S. palmatus*.

Acknowledgment

We wish to thank Nazir Khalil (Damascus, Syria) for providing the studied specimen of *Scorpio jordanensis*.

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Contributions to the scorpion fauna of Iran. Part III. Records of genus *Orthochirus* Karsch, 1891 (Arachnida: Scorpiones: Buthidae)

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Abstract

New locality records are given belonging to *Orthochirus carinatus* Navidpour, Kovařík, Soleglad & Fet, 2019 (Alborz Province), *O. farzanpayi* (Vachon & Farzanpay, 1987) (Fars, Chaharmahal and Bakhtiari and Lorestan Provinces), *O. formozovi* Kovařík, Fet & Yağmur, 2020 (Razavi Khorasan Province), *O. gantenbeini* Kovařík, Yağmur, Fet & Hussen, 2019 (Lorestan Province), *O. iranus* Kovařík, 2004 (Bushehr and Khuzestan Provinces), *O. kucerai* Kovařík & Navidpour, 2020 (Kerman Province), *O. mesopotamicus* Birula, 1918 (Khuzestan Province), *O. navidpouri* Kovařík, Yağmur, Fet & Hussen, 2019 (Ilam, Khuzestan and Lorestan Provinces), *O. stockwelli* (Lourenço & Vachon, 1995) (Fars and Hormozgan Provinces), *O. varius* Kovařík, 2004 (Fars and Kerman Provinces), *O. vignolii* Kovařík & Navidpour, 2020 (Yazd Province) and *O. zagrosensis* Kovařík, 2004 (Fars, Isfahan and Kohgiluyeh and Boyer Ahmad Provinces) in this study. Among them following records are new province records: Chaharmahal and Bakhtiari and Lorestan for *O. farzanpayi*; Lorestan for *O. gantenbeini*; Ilam *O. navidpouri*; Fars for *O. stockwelli*; Fars and Kerman for *O. varius* and Isfahan for *O. zagrosensis*. Also, maps are prepared including new and old distributional localities and coloured habitus pictures of reported species of *Orthochirus* in this study.

Keywords: Scorpion, Scorpiones, *Orthochirus*, Distribution, Iran.

Introduction

Iran has a very rich *Orthochirus* fauna and a hotspot territory for this genus with high level endemism. In Africa and Asia, 58 species of genus *Orthochirus* are known; 19 of these species are distributed in Iran and 16 of them are endemic, i.e. *O. carinatus* Navidpour, Kovařík, Soleglad & Fet, 2019, *O. farzanpayi* (Vachon & Farzanpay, 1987), *O. gantenbeini* Kovařík, Yağmur, Fet & Hussen, 2019, *O. gruberi* Kovařík & Fet, 2006, *O. hormozganensis* Kovařík & Navidpour, 2020, *O. iranus* Kovařík, 2004, *O. kermanensis* Kovařík & Navidpour, 2020, *O. kucerai* Kovařík & Navidpour, 2020, *O. masihipouri* Kovařík & Navidpour, 2020, *O. navidpouri* Kovařík, Yağmur, Fet & Hussen, 2019, *O. sejnai* Kovařík, Fet & Yağmur, 2020, *O. semnanensis* Kovařík & Navidpour, 2020, *O. stockwelli* (Lourenço & Vachon, 1995), *O. varius* Kovařík, 2004, *O. vignolii* Kovařík & Navidpour, 2020, and *O. zagrosensis* Kovařík, 2004) (Kovařík *et al.*, 2019, 2020; Kovařík & Navidpour, 2020; Rein, 2023).

This paper is the third one of papers on scorpion fauna of Iran and reports new distributional records of 12 species of genus *Orthochirus* known in Iran.

Material and Methods

Field trips were carried out between 1991 and 2019, and 100 specimens have been collected from 66 different localities in Alborz, Bushehr, Chaharmahal and Bakhtiari, Fars, Hormozgan, Ilam, Isfahan, Kerman, Khuzestan, Kohgiluyeh and Boyer Ahmad, Lorestan, Qom, Razavi Khorasan and Yazd Provinces. Scorpions were collected by hand from under the stones during the daytime and preserved in 96% alcohol and deposited in personal collection of Abolfazl Akbari and AZMM (Zoology Museum of Alaşehir Vocational School, Celal Bayar University, Manisa, Türkiye). Identification of specimens was done according to Kovařík & Navidpour (2020), Kovařík *et al.* (2019, 2020), and Navidpour *et al.* (2013, 2019). Abbreviations used: FKCP = František Kovařík private collection, Prague, Czech Republic; MNHN = Muséum National d'Histoire Naturelle, Paris; NHMW = Naturhistorisches Museum Wien; ZISP = Zoologicheskii Institut St. Petersburg, Russia.

Results

Family **Buthidae** C.L. Koch, 1837
Genus ***Orthochirus*** Karsch, 1891

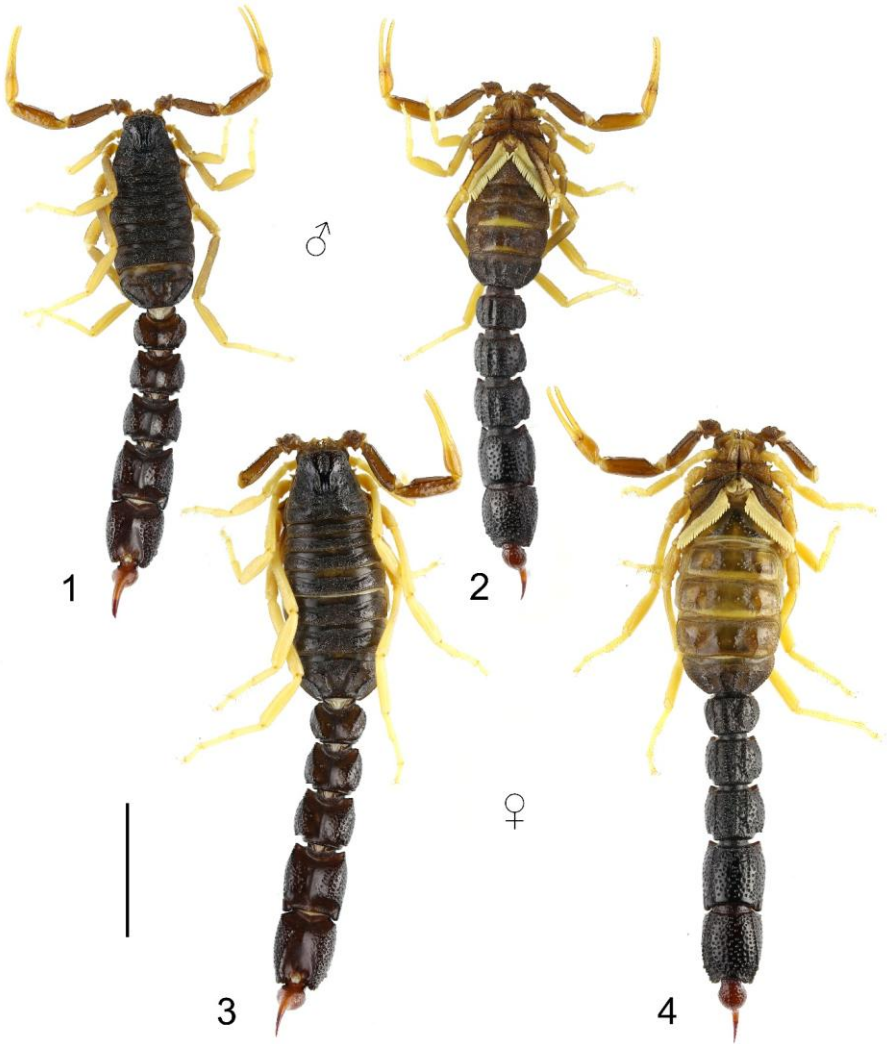
Orthochirus carinatus Navidpour, Kovařík, Soleglad & Fet, 2019
Figs. 1-4.

Type Locality and Type Depository: Iran, Tehran Province, Tehran to Firoozkooh, Absard-Keylan, 35°31'33"N, 52°10'42"E, 1761 m a.s.l.; FKCP.

Examined material: Alborz Province, Eshtahard, 35°43'34"N, 50°22'08"E, 1162 m, 1♂, 2♀♀.

World Distribution: Iran (Navidpour *et al.*, 2019).
Distribution in Iran: Alborz and Tehran Provinces (Fig. 5).

Comments: This species was recently described by Navidpour *et al.* (2019) from Alborz and Tehran Provinces. It has not been confirmed since its description. We confirm it from Alborz Province here.



Figs. 1-4. *Orthochirus carinatus* Navidpour, Kovařík, Soleglad & Fet, 2019, Habitus. 1-2. ♂. 3-4. ♀. 1,3. dorsal view. 2,4. ventral view.

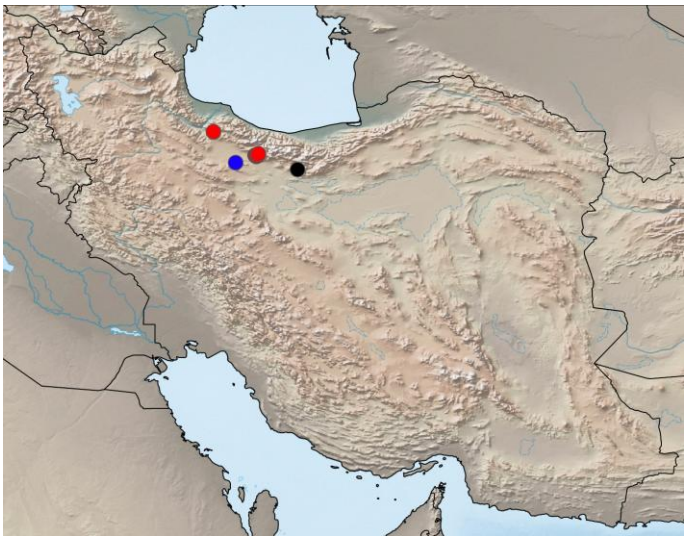
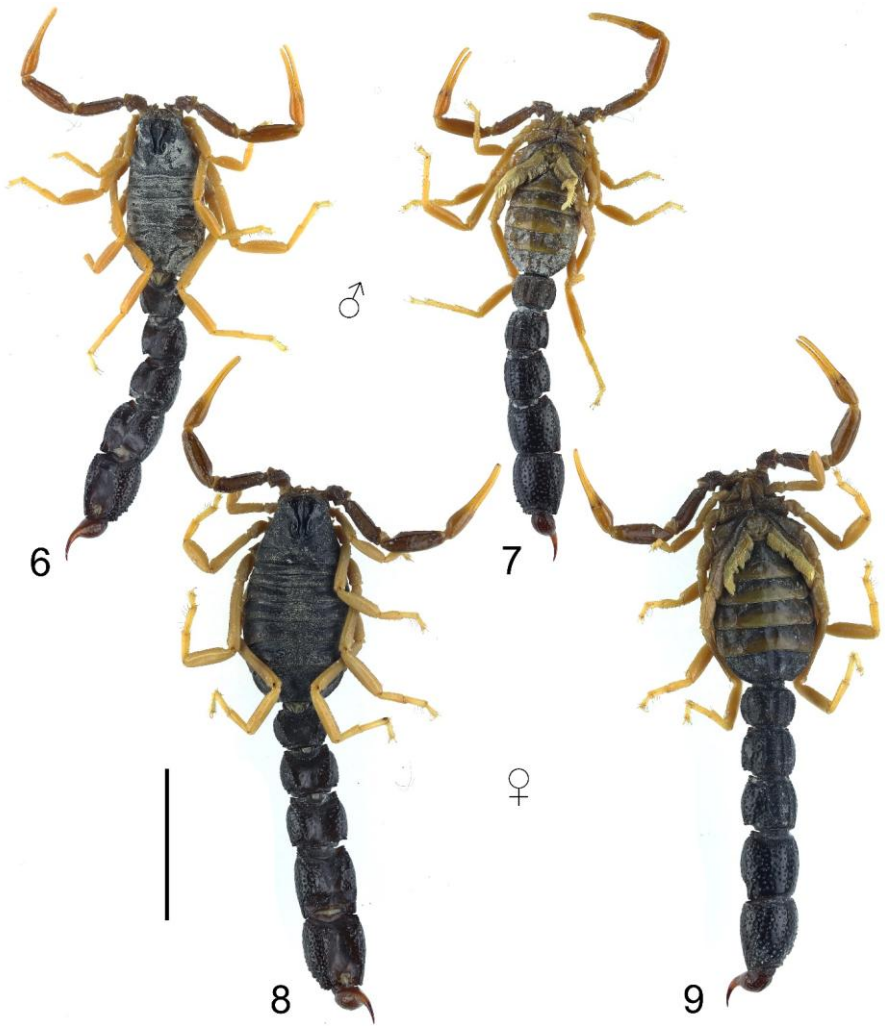


Fig. 5. Map of the distribution of *Orthochirus carinatus* Navidpour, Kovařík, Soleglad & Fet, 2019 in Iran. Black circle: Type locality, Red circles: Literature records, Blue circle: Collected in this study.



Figs. 6-9. *Orthochirus farzanpayi* (Vachon & Farzanpay, 1987), Habitus. 6-7. ♂. 8-9. ♀. 6,8. dorsal view. 7,9. ventral view.

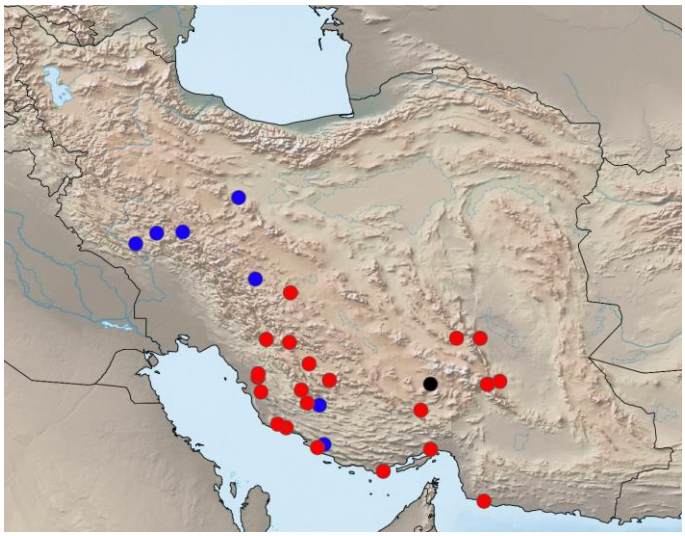


Fig. 10. Map of the distribution of *Orthochirus farzanpayi* (Vachon & Farzanpay, 1987) in Iran. Black circle: Type locality, Red circles: Literature records, Blue circles: Collected in this study.

Orthochirus farzanpayi (Vachon & Farzanpay, 1987)
Figs. 6-9.

Type Locality and Type Depository: Iran, Hormozgan Province, 215 km north of Bandar Abbas; NHMW.

Synonyms:
Simonoides farzanpayi Vachon et Farzanpay in Farzanpay, 1987: 162; Farzanpay, 1988: 41; Fet & Lowe, 2000: 223.
Orthochirus farzanpayi: Kovařík & Fet, 2006: 1, figs. 1-3; Navidpour *et al.*, 2008a: 14; Navidpour *et al.*, 2008b: 15, figs. 2, 23, 61-64; Navidpour *et al.*, 2011: 15, figs. 14, 53-56; Navidpour *et al.*, 2012: 16, fig. 12; Navidpour *et al.*, 2013: 14; Barahoei *et al.*, 2020: 402-403.
= *Orthochirus sobotniki* Kovařík, 2004: 20 (syn. by Kovařík & Fet, 2006: 1).
= *Paraorthochirus goyffoni* Lourenço et Vachon, 1995: 301; Fet & Lowe, 2000: 212 (syn. by Navidpour *et al.*, 2013).

Examined material: Chaharmahal and Bakhtiari Province, Sharkord, 32°07'56"N, 51°10'58"E, 2155 m, 1 juv.; **Fars Province,** Lamard, 27°20'32"N, 53°10'36"E, 417 m, 1♂; Firuzabad, Ghir, 28°28'43.0"N, 53°02'33.0"E, 750 m, 1♂; **Lorestan Province,** Dorud, 33°29'36"N, 49°04'30"E, 1455 m, 1♀; Khorramabad, Visban, 33°27'33"N, 48°19'14"E, 1160 m, 1♀; Khorramabad, Pol-e Dokhtar, 33°09'13"N, 47°42'49"E, 669 m, 1 juv.; **Qom Province,** Tayeqan, 34°29'20"N, 50°41'47"E, 1095 m, 1♂.

World Distribution: Iran (Kovařík *et al.*, 2020).
Distribution in Iran: Bushehr (Akbari *et al.*, 1997), Fars (Kovařík, 1997), Hormozgan (Farzanpay, 1987; Lourenço & Vachon, 1995; Kovařík & Fet, 2006), Kerman (Kovařík & Fet, 2006), Khuzestan (Navidpour *et al.*, 2008a), Kohgilouyeh and Boyer Ahmad (Kovařík & Fet, 2006), Chaharmahal and Bakhtiari and Lorestan (this study) Provinces (Fig. 10).

Comments: This species is widely distributed in southwest of Iran. It is recorded from Chaharmahal and Bakhtiari and Lorestan Provinces in this study.

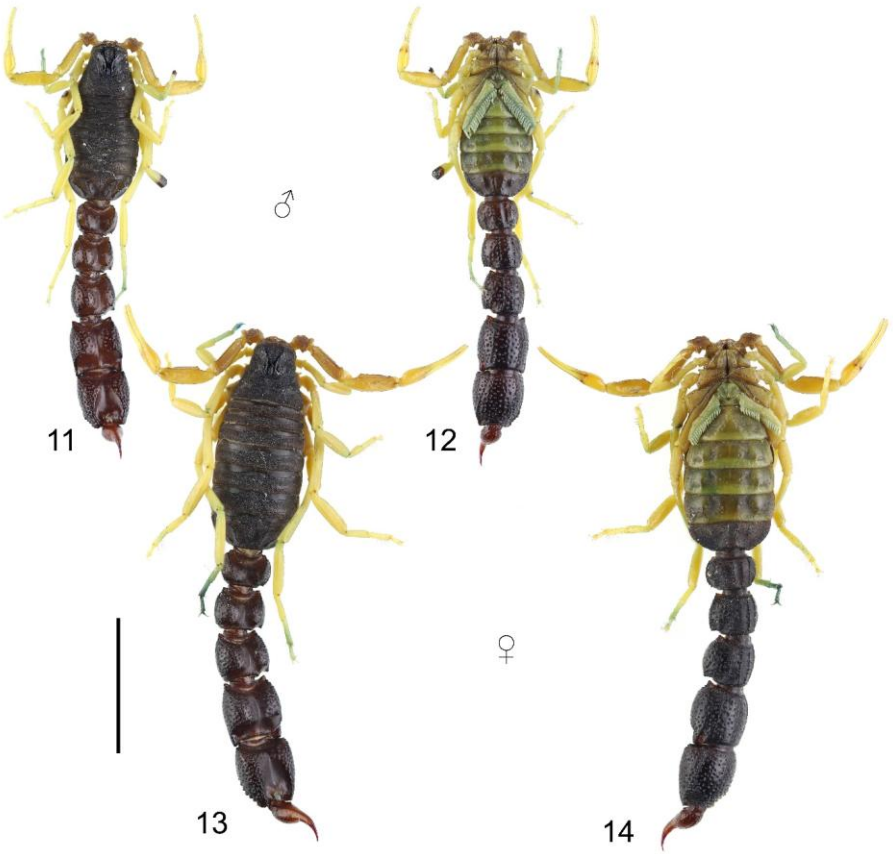
Orthochirus formozovi Kovařík, Fet & Yağmur, 2020
Figs. 11-14.

Type Locality and Type Depository: Turkmenistan, Mary Province, Badkhyz Nature Reserve, ca 14-16 km SSW of Kyzyldzhar cordon (field station), near Eroilanduz Salt Lake, 35º40'33"N, 61º49'18"E to 35º42'04"N, 61º48’53"E, 340-350 m a.s.l.; FKCP.

Examined material: Razavi Khorasan Province, Chahak, 36°02'12"N, 60°07'25"E, 876 m, 4♀♀; Shurak Maleki, 36°04'04"N, 60°13'09"E, 821 m, 4♀♀; Esmailabad, 36°40'19"N, 57°28'26"E, 1085 m, 2♀♀; Sarakhs, 36°32'48"N, 61°09'12"E, 277 m, 2♀♀; Mazdavand, 36°09'23"N, 60°31'50"E, 910 m, 2♂♂; Sefidsang, 35°39'38"N, 60°05'37"E, 1256 m, 2♀♀; Fariman, 35°41'58"N, 59°50'55"E, 1406 m, 3♀♀; Torbat-e-Jam, 35°14'08"N, 60°37'54"E, 1♂, 2♀♀.

World Distribution: Afghanistan, Iran, Tajikistan, Turkmenistan (Kovařík *et al.*, 2020).
Distribution in Iran: Razavi Khorasan Province (Kovařík *et al.*, 2020) (Fig. 15).

Comments: This species is widely distributed in Central Asia. It spreads from the regions of Iran close to the Turkmenistan border to the south of Tajikistan and the north of Afghanistan.



Figs. 11-14. *Orthochirus formozovi* Kovařík, Fet & Yağmur, 2020, Habitus. 11-12. ♂. 13-14. ♀. 11,13. dorsal view. 12,14. ventral view.

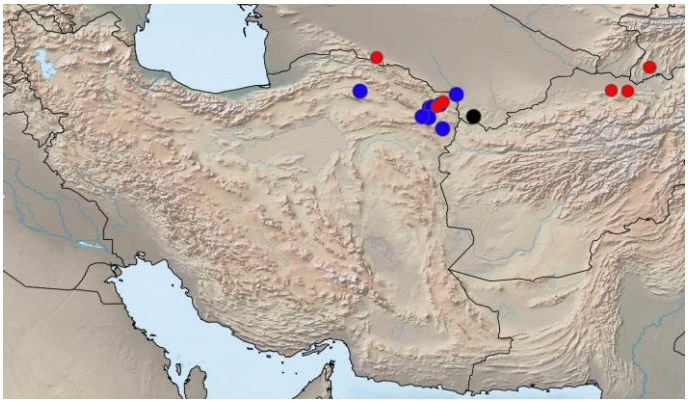


Fig. 15. Map of the distribution of *Orthochirus formozovi* Kovařík, Fet & Yağmur, 2020 in Iran. Black circle: Type locality, Red circles: Literature records, Blue circles: Collected in this study.

Orthochirus gantenbeini Kovařík, Yağmur, Fet & Hussen, 2019
Figs. 16-19.

Type Locality and Type Depository: Iran, Khoozestan Province, Dezful District, Shahyoon village, 32°36'41"N, 48°33'36"E, 527 m a.s.l.; FKCP.

Examined material: Lorestan Province, Khaneh Sorkh, 33°40'56"N, 47°48'45"E, 1065 m, 1♂, 1♀.

World Distribution: Iran (Kovařík *et al.*, 2019).
Distribution in Iran: Khuzestan Province (Kovařík *et al.*, 2019) and Lorestan Province (this study) (Fig. 20).

Comments: This species has been known only from one locality in Khuzestan Province. It is recorded secondly in this study.

Orthochirus iranus Kovařík, 2004
Figs. 21-24.

Type Locality and Type Depository: Iran, Bushehr Province, ca 17 km NW. Bandar-e-Gonaveh, 29°38'32"N, 50°26'56"E, 10 m. a.s.l.; FKCP.

Synonyms:
Orthochirus iranus Kovařík, 2004: 13-14; Kovařík & Fet, 2006: 8; Navidpour *et al.*, 2008a: 15-20 (in part); Navidpour *et al.*, 2008b: 17; Navidpour *et al.*, 2008c: 11 (in part); Navidpour *et al.*, 2008d: 7, figs. 39-42; Navidpour *et al.*, 2010: 15 (in part); Mirshamsi *et al.*, 2011: 20; Barahoei *et al.*, 2020: 405; Kovařík *et al.*, 2019: 12.

Examined material: Bushehr Province, Bandar Deylam, 30°03'15"N, 50°09'32"E, 4 m, 1♂; Dashtestan, 29°07'12"N, 51°29'24"E, 1068 m, 1♀; **Khuzestan Province,** Chah Salem, 30°43'36"N, 49°43'57"E, 29 m, 1♀; Hamidiyeh, 31°28'29"N, 48°25'56"E, 21 m, 1♂, 1♀; Hovizeh, 31°27'55"N, 48°04'44"E, 14 m, 1♀; Omidiyeh, 30°45'27"N, 49°41'15"E, 22 m, 1♂; Miyankoh, 30°47'20"N, 49°43'34"E, 96 m, 1♀.

World Distribution: Iran (Kovařík *et al.*, 2020).
Distribution in Iran: Bushehr (Kovařík, 1997), Ilam (Navidpour *et al.*, 2008c), Khuzestan (Kovařík, 1997), Kohgilouyeh and Boyer Ahmad (Navidpour *et al.*, 2008d) and Lorestan Provinces (Navidpour *et al.*, 2010) (Fig. 25).

Comments: This species is widely distributed in southwest of Iran and south of Iraq. It is confirmed from Bushehr and Khuzestan Provinces in this study.

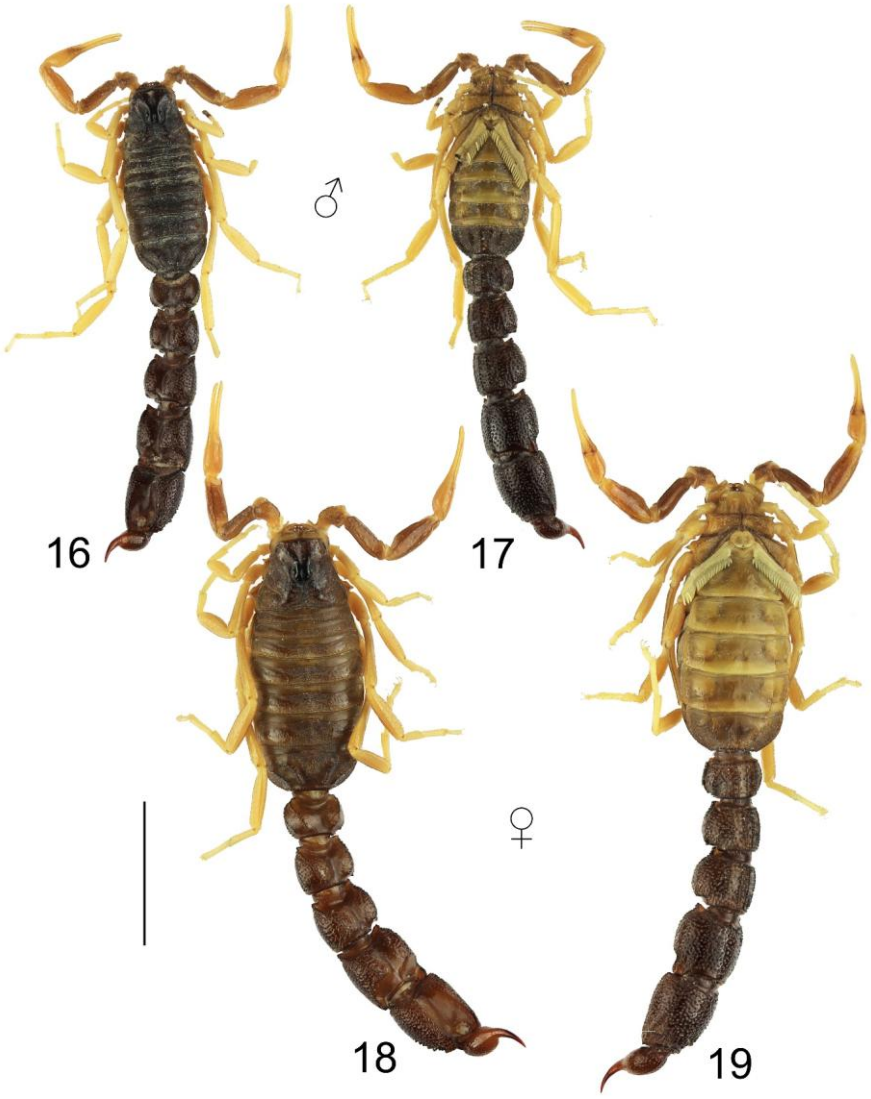
Orthochirus kucerai Kovařík & Navidpour, 2020
Figs. 26-29.

Type Locality and Type Depository: Iran, Kerman Province, Sar Telo, Khajeh Askar Village, 29°10'01"N, 58°16'27"E, 1155 m a.s.l.; FKCP.

Examined material: Kerman Province, Jiroft, 28°40'41.0"N, 57°44'26.0"E, 681 m, 2♂♂, 1♀.

World Distribution: Iran (Kovařík *et al.*, 2020).
Distribution in Iran: Kerman (Kovařík *et al.*, 2020) (Fig. 30).

Comments: This species is known only in Kerman Province. Our record is from Jiroft district, and it was reported here earlier by Adeli-Sardou *et al.* (2024).



Figs. 16-19. *Orthochirus gantenbeini* Kovařík, Yağmur, Fet & Hussen, 2019, Habitus. 16-17. ♂. 18-19. ♀. 16,18. dorsal view. 17,19. ventral view.

Fig. 20. Map of the distribution of *Orthochirus gantenbeini* Kovařík, Yağmur, Fet & Hussen, 2019 in Iran. Black circle: Type locality, Blue circle: Collected in this study.

Figs. 21-24. *Orthochirus iranus* Kovařík, 2004, Habitus. 21-22. ♂. 23-24. ♀. 21,23. dorsal view. 22,24. ventral view.

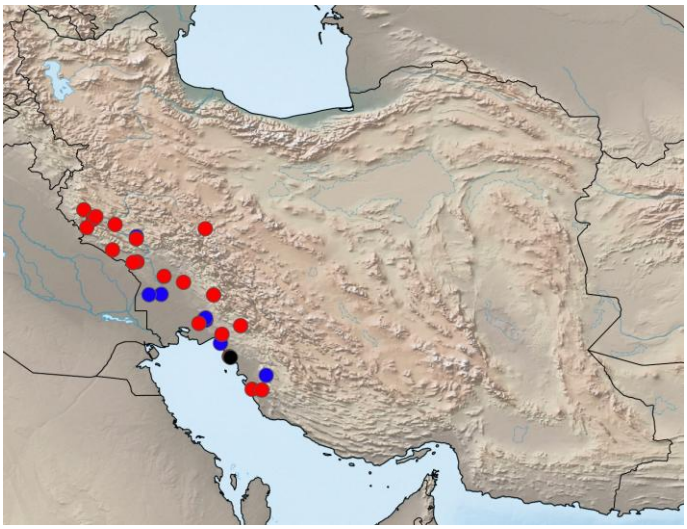


Fig. 25. Map of the distribution of *Orthochirus iranus* Kovařík, 2004 in Iran. Black circle: Type locality, Red circles: Literature records, Blue circles: Collected in this study.

Orthochirus mesopotamicus Birula, 1918
Figs. 31-34.

Type Locality and Type Depository: Iran, Khoozestan Province, Karun River, Kut-e-Gazaie, camp of Sheikh Gazal near Ahvaz; ZISP.

Synonyms:
Orthochirus scrobiculosus mesopotamicus Birula, 1918: 35-42; Birula, 1928: 83; Vachon, 1966: 214; Levy & Amitai, 1980: 94; Fet, 1989: 116; Fet, 1994: 530; Kovařík, 1998: 116; Fet & Lowe, 2000: 199; Kovařík, 2004: 19, 20.
Orthochirus mesopotamicus: Kovařík *et al.*, 2019: 16-21; Barahoei *et al.*, 2020: 405.
Orthochirus iranus (in part): Navidpour *et al.*, 2008a: 15-20, figs. 4, 19, 24-26, 27-30, 31, 97-100, table 2; Navidpour *et al.*, 2008c: 8, 10, 11, 50-53.

Examined material: Khuzestan Province, Omidiyeh, Dobandi, 30°45'27"N, 49°41'15"E, 20 m, 1♂; Sarband, 30°48'00"N, 49°46'07"E, 238 m, 1♀.

World Distribution: Iraq, Iran (Kovařík *et al.*, 2019).
Distribution in Iran: Ilam and Khuzestan (Kovařík *et al.*, 2019) (Fig. 35).

Comments: This species was described from Iran and Iraq by Birula (1918). Kovařík *et al.* (2019) redescribed and reported it from Ilam and Khuzestan Provinces. It is confirmed from Khuzestan Province in this study.

Orthochirus navidpouri Kovařík, Yağmur, Fet & Hussen, 2019
Figs. 36-39.

Type Locality and Type Depository: Iran, Lorestan Province, Koramabad, Haftcheshmeh Village, 33°48'39"N, 47°46'03"E, 1398 m a.s.l.; FKCP.

Examined material: Ilam Province, Abdanan, Gandab, 33°03'02"N, 47°15'44"E, 1234 m, 1♂; Derrehshar, Bon Babajan, 33°08'35.0"N, 47°23'08.0"E, 660 m, 2♂♂; Mormuri, 32°43'46"N, 47°40'05"E, 527 m, 1♀; Panjbarar, 32°46'59"N, 47°41'59"E, 654 m, 1♀; **Khuzestan Province,** Andimeshk, Sisakht, 32°21'42"N, 48°20'43"E, 108 m, 1♂; Baghmalek, Dorto, 31°24'58"N, 49°59'29"E, 713 m, 1♀; Baghmalek, 31°31'34"N, 49°52'53"E, 702 m, 1♂, 2♀♀; Bidrobeh, 32°45'39"N, 48°14'01"E, 443 m, 1♀; Ghaleh Tel, 31°38'05"N, 49°53'23"E, 913 m, 1♀; Shoshtar, Mahor, 32°02'28"N, 48°49'57"E, 1♂, 1♀; **Lorestan Province,** Poldokhtar, Malavi, 33°08'46"N, 47°43'08"E, 697 m, 3♀♀.

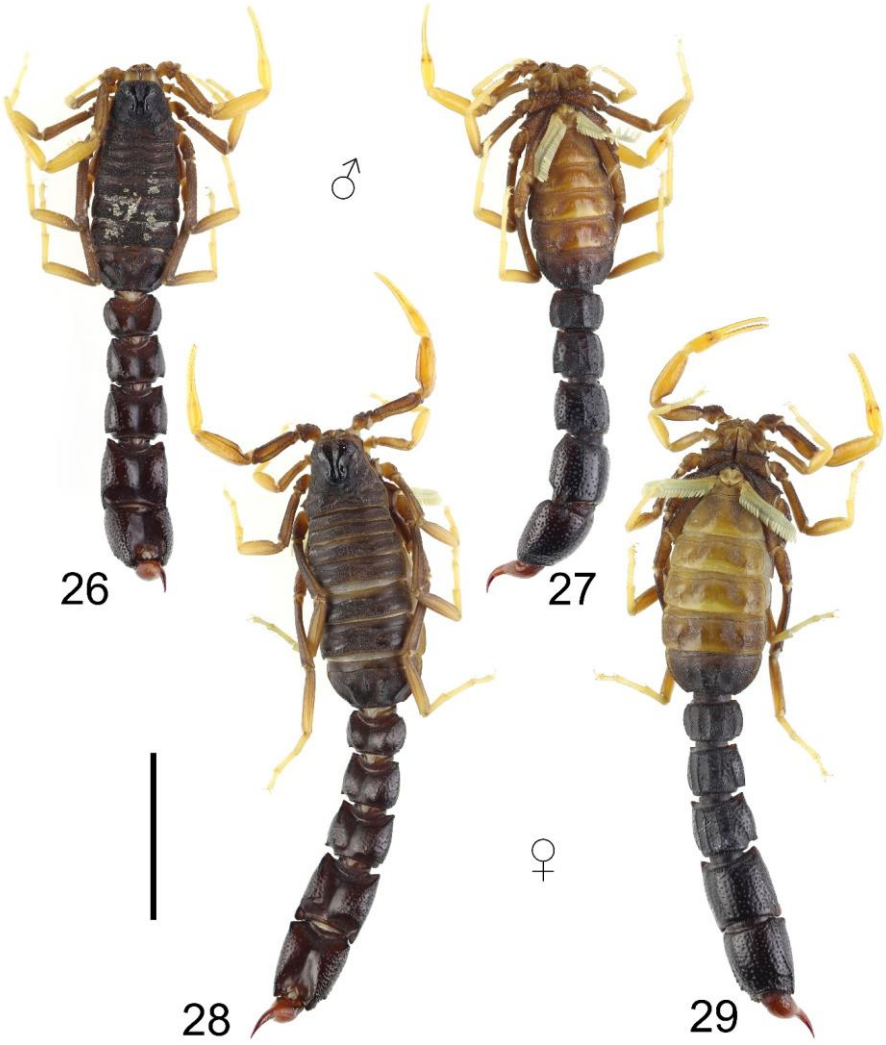
World Distribution: Iran (Kovařík *et al.*, 2019).
Distribution in Iran: Ilam (this study), Khuzestan and Lorestan Provinces (Kovařík *et al.*, 2019) (Fig. 40).

Comments: This species was described from Khuzestan and Lorestan Provinces (Kovařík *et al.*, 2019). It is confirmed from Khuzestan and Lorestan Provinces and recorded from Ilam for the first time in this study.

Orthochirus stockwelli (Lourenço & Vachon, 1995)
Figs. 41-44.

Type Locality and Type Depository: Iran, Hormozgan Province, Bandar-Abbas; MNHN.

Synonyms:
Paraorthochirus stockwelli Lourenço & Vachon, 1995: 299; Lourenço & Vachon, 1997: 329; Kovařík, 1997: 50; Kovařík, 1998: 117; Fet & Lowe, 2000: 212; Kovařík & Fet, 2006: 9.
Orthochirus stockwelli: Navidpour *et al.*, 2008a: 20; Navidpour *et al.*, 2008b: 17; Navidpour *et al.*, 2013: 17; Kovařík *et al.*, 2020; Barahoei *et al.*, 2020: 409; Yağmur *et al.*, 2023: 44-49.



Figs. 26-29. *Orthochirus kucerai* Kovařík & Navidpour, 2020, Habitus. 26-27. ♂. 28-29. ♀. 26,28. dorsal view. 27,29. ventral view.

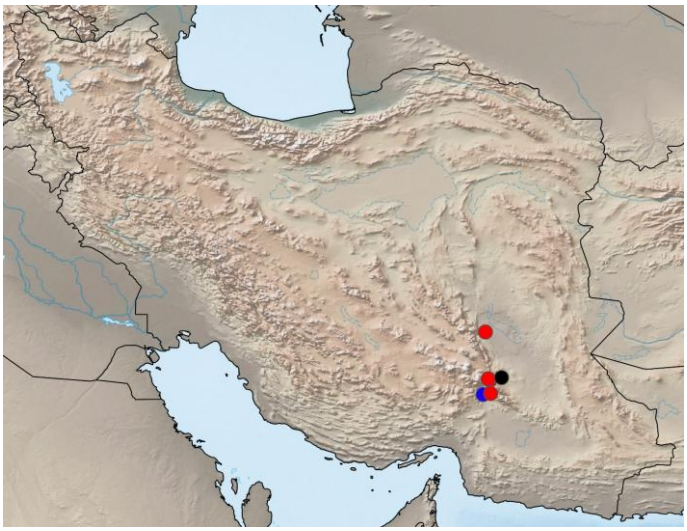
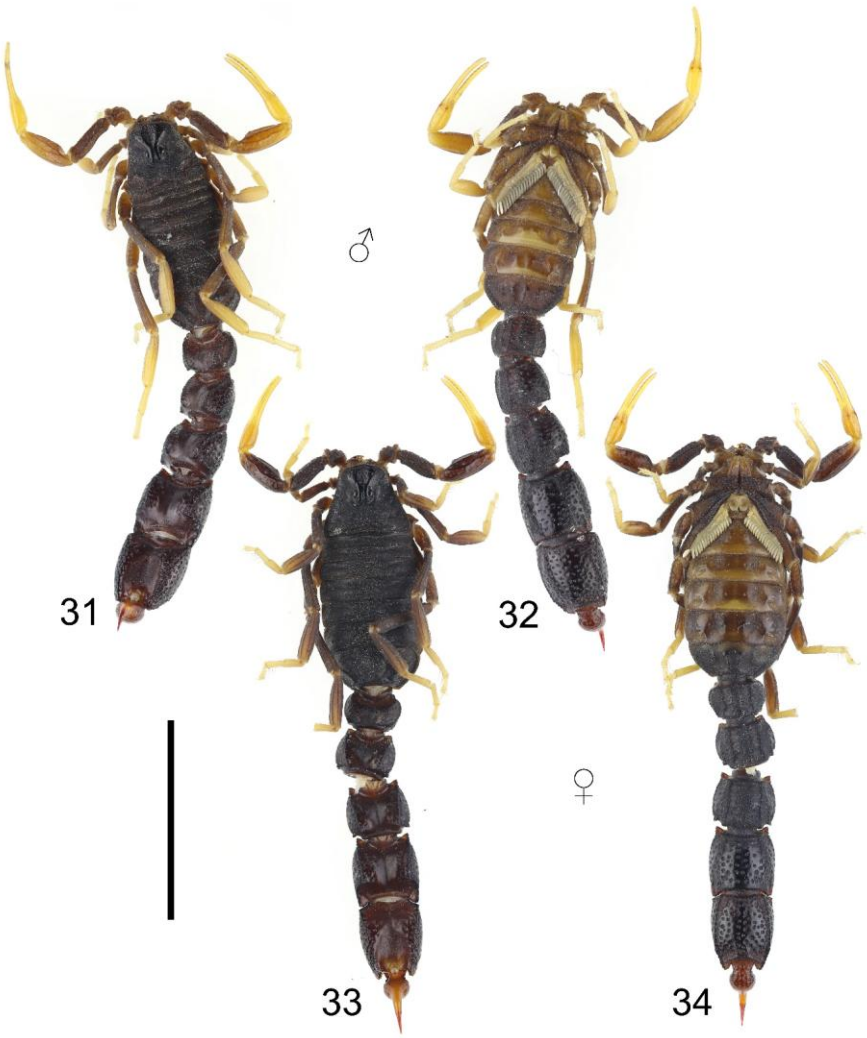


Fig. 30. Map of the distribution of *Orthochirus kucerai* Kovařík & Navidpour, 2020 in Iran. Black circle: Type locality, Red circles: Literature records, Blue circle: Collected in this study.



Figs. 31-34 *Orthochirus mesopotamicus* Birula, 1918, Habitus. 31-32. ♂. 33-34. ♀. 31,33. dorsal view. 32,34. ventral view.

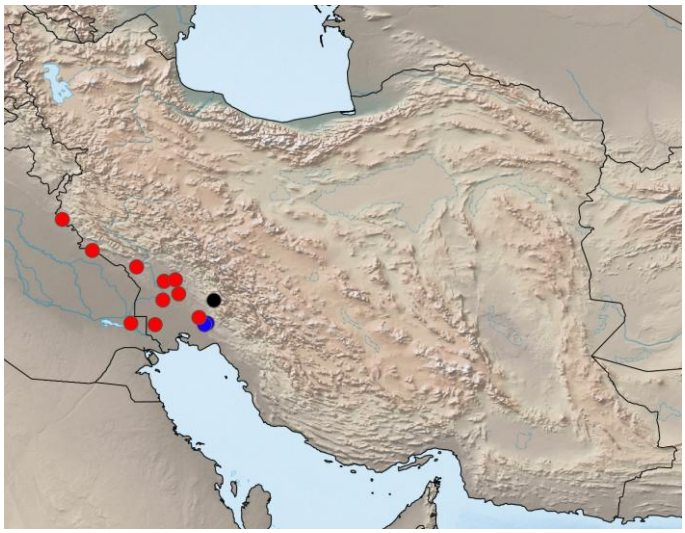


Fig. 35. Map of the distribution of *Orthochirus mesopotamicus* Birula, 1918 in Iran. Black circle: Type locality, Red circles: Literature records, Blue circles: Collected in this study.

Figs. 36-39. *Orthochirus navidpouri* Kovařík, Yağmur, Fet & Hussen, 2019, Habitus. 36-37. ♂. 38-39. ♀. 36,38. dorsal view. 37,39. ventral view.

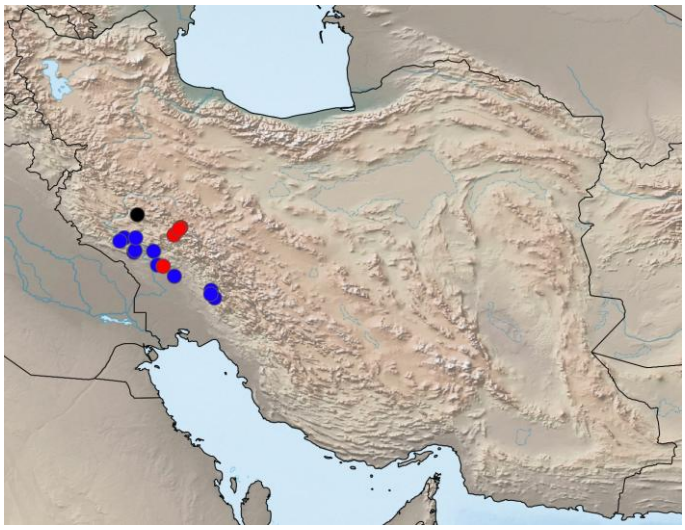


Fig. 40. Map of the distribution of *Orthochirus navidpouri* Kovařík, Yağmur, Fet & Hussen, 2019 in Iran. Black circle: Type locality, Red circles: Literature records, Blue circles: Collected in this study.

Examined material: Fars Province, Fasa, 28°56'18"N, 53°38'54"E, 1395 m, 1♀; **Hormozgan Province,** Amani, 27°13'00"N, 53°02'21"E, 57 m, 1♂, 1♀.

World Distribution: Iran (Yağmur *et al.*, 2023).
Distribution in Iran: Bushehr, Hormozgan and Khuzestan Provinces (Yağmur *et al.*, 2023) (Fig. 45).

Comments: This species was described from Hormozgan Province by Lourenço & Vachon (1995). Subsequently, it was redescribed by Yağmur *et al.* (2023).

Orthochirus varius Kovařík, 2004
Figs. 46-49.

Type Locality and Type Depository: Iran, Hormozgan Province, Beshagerd Mts., Davari Village, 26º27'N, 57º38'E; FKCP.

Examined material: Fars Province, Firuzabad, 28°48'22"N, 52°38'00"E, 1350 m, 2♀♀; Kazeron, 29°37'40"N, 51°39'45"E, 895 m, 1♀; Khonj, Ard, 27°54'17"N, 53°25'15"E, 677 m, 1♀; Lar, 27°39'20"N, 54°17'07"E, 827 m, 1♀; Lar, Hermorbagh, 27°38'55"N, 54°21'28"E, 410 m, 1♀; Lar, Ravoz, 27°45'30"N, 54°01'18"E, 948 m, 1♀; Shiraz, 29°37'14"N, 52°24'14"E, 1714 m, 1♀; **Kerman Province,** Kahnoj, Bargah, 27°58'45"N, 57°44'09"E, 486 m, 2♂♂, 1♀; Kahnoj, Serajiband, 27°54'15"N, 57°36'58"E, 520 m, 1♂.

World **Distribution:** Iran (Kovařík, 2004).
Distribution in Iran: Fars and Kerman (this study), Hormozgan (Kovařík, 2004) (Fig. 50).

Comments: This species was described from Hormozgan Province by Kovařík (2004). It is recorded for the first time from Fars and Kerman in this study.

Orthochirus vignolii Kovařík & Navidpour, 2020
Figs. 51-52.

Type Locality and Type Depository: Iran, Yazd Province, Kosk Abad Village, 31º43'52"N, 53º17'12"E, 2023 m a.s.l.; FKCP.

Examined material: Yazd Province, Bakh, 31°18'31"N, 54°05'02"E, 1♂.

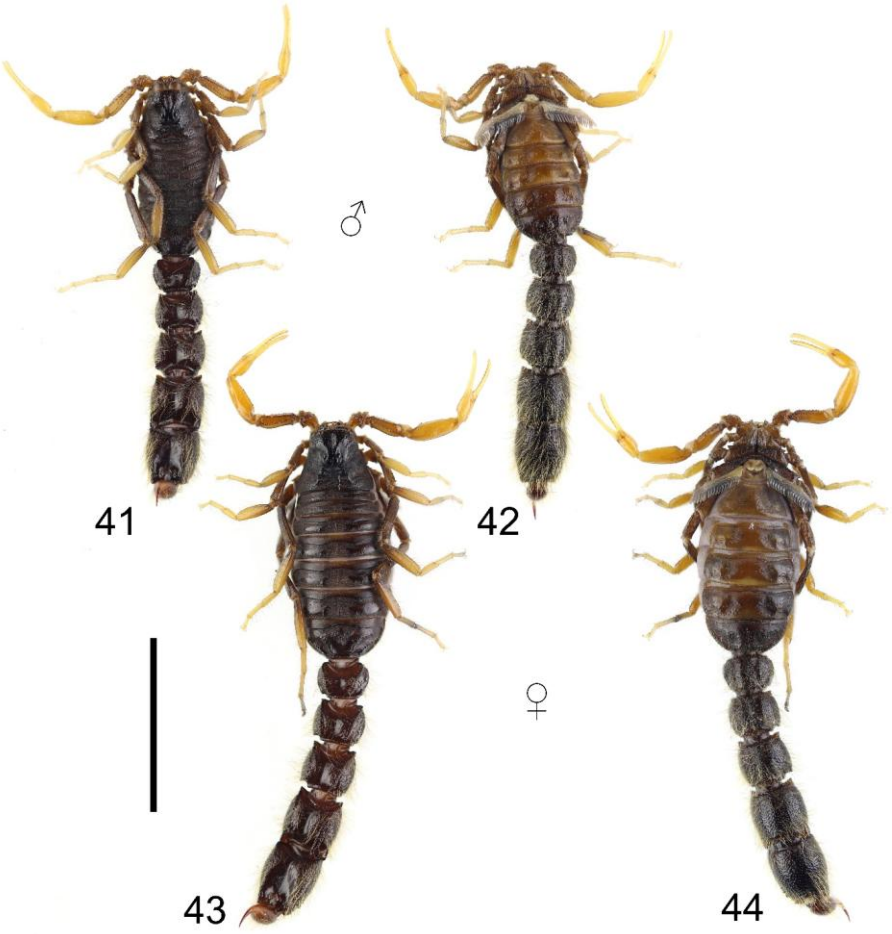
World Distribution: Iran (Kovařík & Navidpour, 2020).
Distribution in Iran: Yazd Province (Kovařík & Navidpour, 2020) (Fig. 53).

Comments: This species was described from Yazd Province by Kovařík & Navidpour (2020). It is confirmed from Yazd Province in this study.

Orthochirus zagrosensis Kovařík, 2004
Figs. 54-57.

Type Locality and Type Depository: Iran, Fars Province, Dasht-e-Arzhan, 29°34'N, 51°56'E, 2000 m. a.s.l.; FKCP.

Synonyms:
Orthochirus zagrosensis Kovařík, 2004: 22; Kovařík & Fet, 2006: 8, figs. 7-8; Navidpour *et al.*, 2008a: 20; Navidpour *et al.*, 2008d: 7; Pirali-Kheirabadi *et al.*, 2009: 10, figs. 2-3,



Figs. 41-44. *Orthochirus stockwelli* (Lourenço & Vachon, 1995), Habitus. 41-42. ♂. 43-44. ♀. 41,43. dorsal view. 42,44. ventral view.

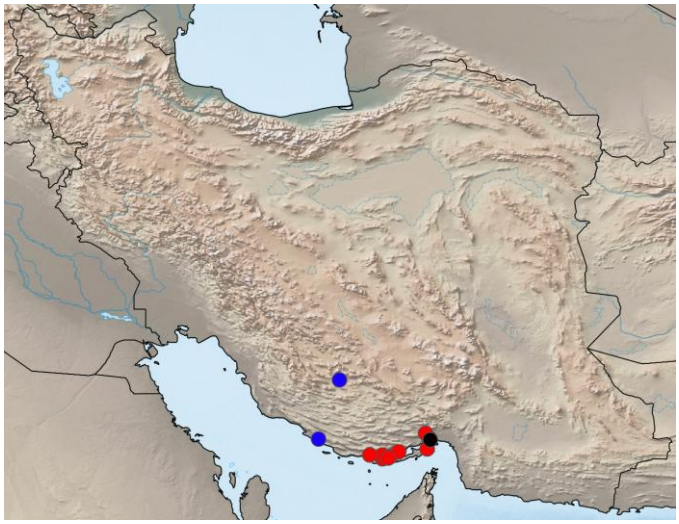
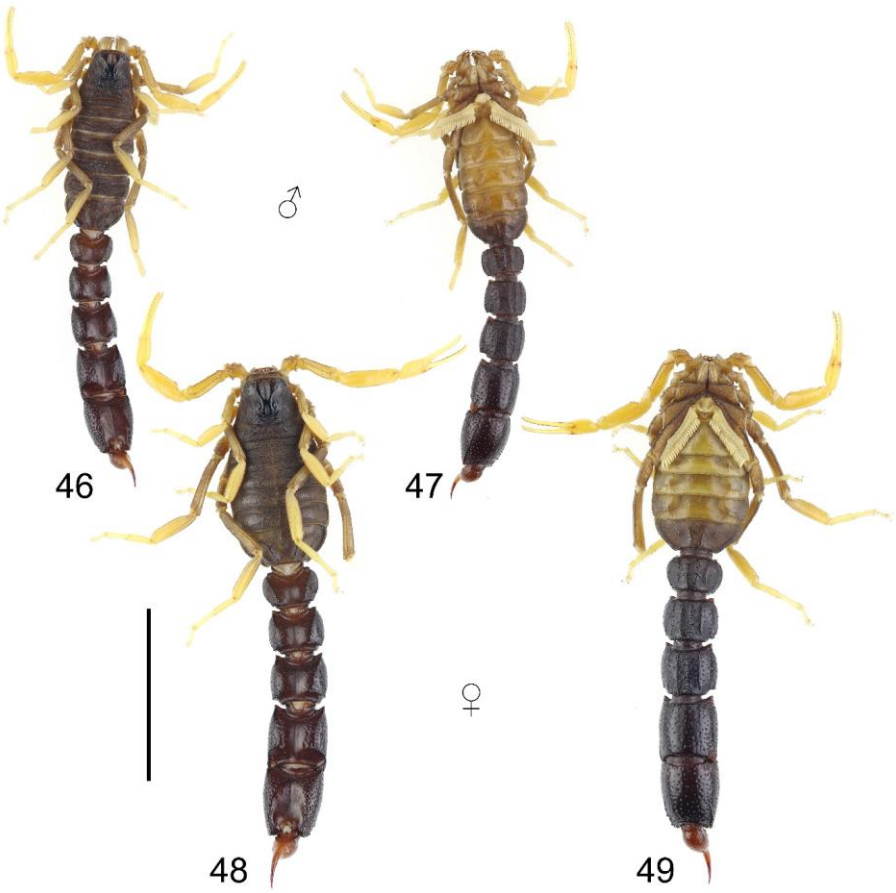


Fig. 45. Map of the distribution of *Orthochirus stockwelli* (Lourenço & Vachon, 1995) in Iran. Black circle: Type locality, Red circles: Literature records, Blue circles: Collected in this study.



Figs. 46-49. *Orthochirus varius* Kovařík, 2004, Habitus. 46-47. ♂. 48-49. ♀. 46,48. dorsal view. 47,49. ventral view.

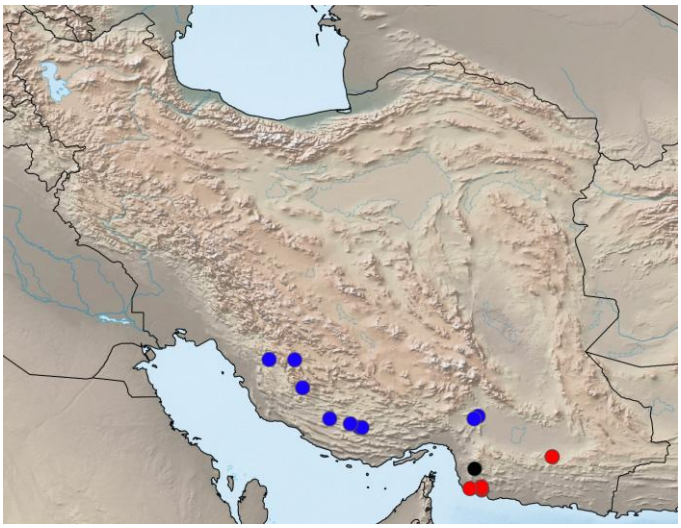


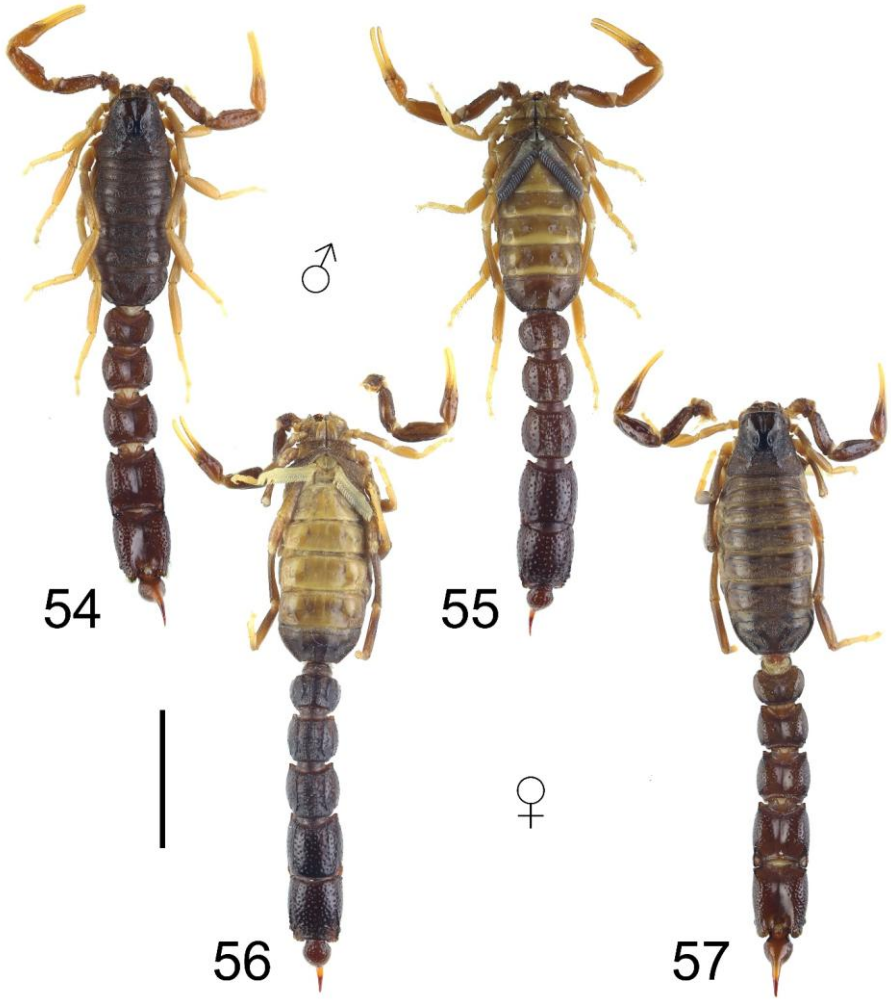
Fig. 50. Map of the distribution of *Orthochirus varius* Kovařík, 2004 in Iran. Black circle: Type locality, Red circles: Literature records, Blue circles: Collected in this study.

5,8,10, 36-39; Navidpour *et al.*, 2011: 17, figs. 14, 49-52; Navidpour *et al.*, 2012: 17; Kovařík *et al.*, 2019: 26; Barahoei *et al.*, 2020: 409-410.
Orthochirus farzanpayi: Navidpour *et al.*, 2008a: 14-15, figs. 31, 93-94 (in part, specimens from Khoozestan Province).

Examined material: Fars Province, Ardakan, 30°14'26.3"N, 51°59'38.7"E, 2177 m, 1♂; Fasa, Akbaabad, 28°56'55"N, 53°38'03"E, 1394 m, 1♂; **Isfahan Province,** Aranbidgel, 34°03'28"N, 51°29'03"E, 910 m, 1♀; Aranbidgel, Noshabad, 34°03'33"N, 51°28'40"E, 910 m, 2♀♀; Kashan, Fakhreh, 33°58'53"N, 51°24'45"E, 943 m, 1♀; Najafabad, 32°50′43″N, 51°36′00″E, 1589 m, 1♂; Natanz, Henjen, 33°30′48″N, 51°54′59″E, 1641 m, 2♀♀; Natanz, Solhabad, 33°34'41"N, 51°47'56"E, 1545 m, 1♀; Natanz, Oreh, 33°43'31"N, 51°43'32"E, 1297 m, 2♀♀; Selirum, Ghaleh Ghadam, 31°23'52"N, 51°34'45"E, 2332 m, 1♂; Selirum, Komeh, 31°24′51″N, 51°34′10″E, 2397 m, 1♂, 1♀; Selirum, Mork, 31°23'52"N, 51°34'45"E, 2332 m, 1♀, 1 juv.; Selirum, Vanak, 31°31'39"N, 51°19'48"E, 2096 m, 2♀♀; **Kohgiluyeh and Boyer Ahmad Province Province,** Yasuj, Sisakht, 30°51'22.0"N, 51°27'18.0"E, 2190 m, 1♂, 3♀♀; Yasuj, Vazak, 30°40'06"N, 51°35'17"E, 1842 m, 1♂.

Figs. 51-52. *Orthochirus vignolii* Kovařík & Navidpour, 2020, ♂ Habitus. 51. dorsal view. 52. ventral view.

Fig. 53. Map of the distribution of *Orthochirus vignolii* Kovařík & Navidpour, 2020 in Iran. Black circle: Type locality, Red circles: Literature records, Blue circle: Collected in this study.



Figs. 54-57. *Orthochirus zagrosensis* Kovařík, 2004, Habitus. 54-55. ♂. 56-57. ♀. 54, 56. dorsal view. 55, 57. ventral view.

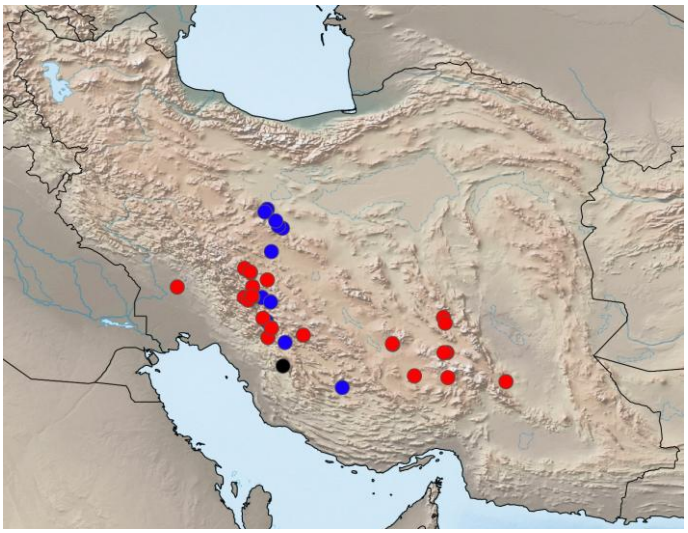


Fig. 58. Map of the distribution of *Orthochirus zagrosensis* Kovařík, 2004 in Iran. Black circle: Type locality, Red circles: Literature records, Blue circles: Collected in this study.

World Distribution: Iran (Kovařík *et al.*, 2019).
Distribution in Iran: Chaharmahal and Bakhtiyari (Pirali-Kheirabadi *et al.*, 2009), Fars and Isfahan (Kovařík, 2004), Kerman (Kovařík & Fet, 2006), Khuzestan (Kovařík *et al.*, 2019) and Kohgilouyeh and Boyer Ahmad (Kovařík, 1997) Provinces (Fig. 58).

Comments: This species is widely distributed in central area of Iran. It is confirmed from Fars, Isfahan and Kohgilouyeh and Boyer Ahmad Provinces in this study.

Discussion

Iran has 19 species of *Orthochirus* and 16 of them are endemic to Iran (*O. carinatus*, *O. farzanpayi*, *O. gantenbeini*, *O. gruberi*, *O. hormozganensis*, *O. iranus*, *O. kermanensis*, *O. kucerai*, *O. masihipouri*, *O. navidpouri*, *O. sejnai*, *O. semnanensis*, *O. stockwelli*, *O. varius*, *O. vignolii*, and *O. zagrosensis*) (Barahoei *et al.*, 2020; Kovařík *et al.*, 2020). *O. formozovi* is distributed in Afghanistan, Tajikistan, Turkmenistan (Kovařík *et al.*, 2020); *O. mesopotamicus* is distributed in Iraq and *O. persa* (Birula, 1900) is distributed in Afghanistan, too.

New locality records are given belonging to *O. carinatus* (Alborz Province), *O. farzanpayi* (Fars, Chaharmahal and Bakhtiari and Lorestan Provinces), *O. formozovi* (Razavi Khorasan Province), *O. gantenbeini* (Lorestan Province), *O. iranus* (Bushehr and Khuzestan Provinces), *O. kucerai* (Kerman Province), *O. mesopotamicus* (Khuzestan Province), *O. navidpouri* (Ilam, Khuzestan and Lorestan Provinces), *O. stockwelli* (Fars and Hormozgan Provinces), *O. varius* (Fars and Kerman Provinces), *O. vignolii* (Yazd Province) and *O. zagrosensis* (Fars, Isfahan and Kohgiluyeh and Boyer Ahmad Provinces) in this study. Among them following records are new province records: Chaharmahal and Bakhtiari and Lorestan for *O. farzanpayi*; Lorestan for *O. gantenbeini*; Ilam for *O. navidpouri*; Fars for *O. stockwelli*; Fars and Kerman for *O. varius* and Isfahan for *O. zagrosensis*.

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On current distribution of *Androctonus aeneas* Koch, 1839 in Algeria (Scorpiones: Buthidae)

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Abstract

This work concerns a new consideration on the geographical distribution of *Androctonus aeneas* C.L. Koch, 1839 (Scorpiones) in Algeria. Historically, this species occupied the central band of Algeria, from Tébessa and Khenchela in the east, through Batna in the Belezma mountains, to Naâma in the west. Recent surveys by young researchers have noted an expansion of the range of this scorpion not only in the geographic distribution area predicted for this species by Lourenço *et al*. (2015) but also towards western Algeria (Aïn Témouchent, Sabdou, El Bayadh and Saïda) and towards the southwest of Algeria in Naâma and Béchar. These new data may enrich the understanding of this potentially dangerous species, but also to the known area of scorpion envenomation risk.

Keywords: *Androctonus aeneas*, Algeria, geographic distribution, habitat.

Introduction

Genus *Androctonus* Ehrenberg, 1828, is represented in Algeria by six species: *A. aeneas* C.L. Koch, 1839, *A. amoreuxi* (Audouin, 1825), *A. australis* (Linnaeus, 1758), *A. eburneus* (Pallary, 1928), *A. hoggarensis* (Pallary, 1929), and *A. Liouvillei* (Pallary, 1929) (Dupré *et al*., 2023). These species have particular bioecological affinities and a wide distribution in this vast country. *Androctonus aeneas* was first described in Algeria by C.L. Koch in 1839 based on specimens from Aïn El-Turk region (Oran). This species has a limited distribution in the Algerian highlands and in Tunisia (Sadine *et al.*, 2011; Sadine, 2012; Lourenço *et al*., 2015; Ouici *et al*., 2020). In Algeria, Vachon (1952) reported its distribution in the central horizontal band extending from Tébessa and Khenchela in the east to Naâma in the west.

Contemporary authors confirmed several localities such as Belezma mountains-Batna (Sadine *et al*., 2012), in Tébessa region (Mekahlia *et al*., 2021; Abidi, 2022), in El-Oued region (Sadine *et al*., 2011; Sadine, 2012) and in the Ghardaïa region (Sadine *et al*., 2014; Sadine *et al*., 2023). It is also found in the steppe area of Khenchela (Meddour *et al*., 2017), as well as in the Tiaret region (Ait Hammou *et al*., 2023) and in Sidi Bel Abbès (Ouici *et al*., 2020).

This species has a morphological variability that complicates its classification (Vachon, 1952) and it is frequently confused with *A. bicolor* Ehrenberg, 1828. Pallary (1924) proposed two subspecies: *A. aeneas aeneas* and *A. aeneas liouvillei*, while Levy & Amitai (1980) suggested *A. bicolor aeneas*. In his famous revision of *Androctonus*, Lourenço (2005) proposed that *A. aeneas* might be a synonym of *A. bicolor* due to a gradient of variations in some populations. Consequently, Sadine *et al*. (2011, 2014) reported it as *A. bicolor* for Algeria in Batna and Ghardaïa.

In Tunisia, Teruel & Kovařík (2014) identified *A. turieli* and consider *A. aeneas* as *nomen dubium* due to the loss of type specimens. However, Lourenço *et al*. (2015) revalidated *A. aeneas* based on a neotype of *A. aeneas* from the type locality of Aïn El-Turk (Oran) and they synonymized these two species.

Therefore, the present work aims to update the spatial distribution of *Androctonus aeneas* in Algeria. Given that this species is classified as potentially dangerous (Sadine *et al*., 2020), the updated distribution map will highlight high-risk areas in terms of scorpion envenomation.

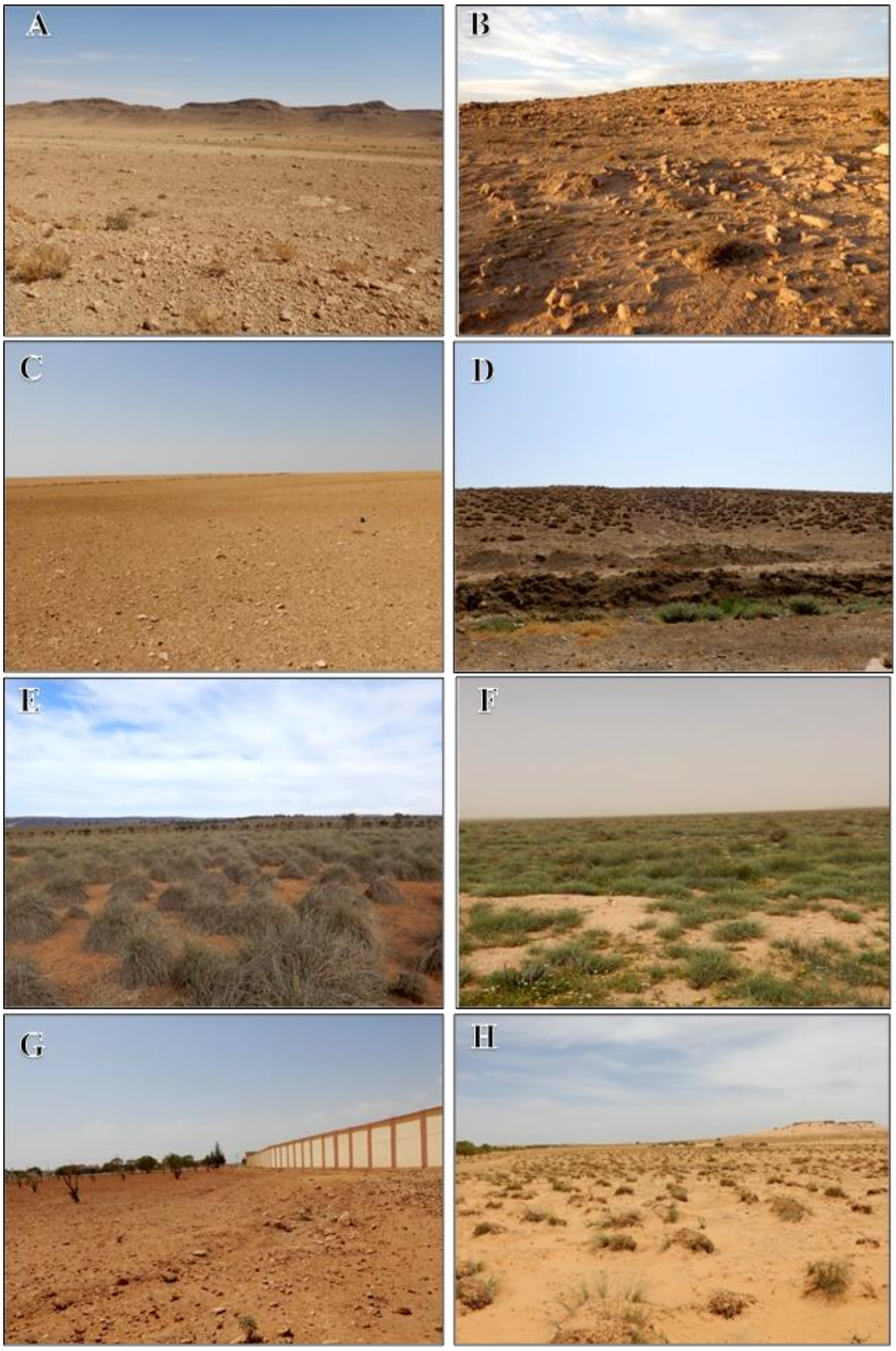

Fig. 1. Different biotopes of *Androctonus aeneas* in Algeria. A. uncultivated plains. B. stony plain. C. abandoned steppe. D. herbaceous layer of *Lygeum spartum*. E. herbaceous layer of Alfa. F. herbaceous layer of *Artemisia*. G. abandoned Almond farm. H. overgrazed Alfa steppe.

Material and Methods

Scorpion sampling

Data on the distribution of *Androctonus aeneas* in Algeria are collected from various sources, including old publications by C.L. Koch (1839), Ehrenberg (1828) and Vachon (1952), as well as recent publications.

The collecting of new scorpion material was carried out by a team of young researchers (authors of this note). During the period from January 2021 to September 2024, several stations (different biotopes) were explored (Fig. 1), including the southern steppes and large uncultivated plains of grassy expanses with sandy formations, herbaceous layer of Alfa and *Artemisia*, *Atriplex* plantations, and some Matorral and Garrigues.

Additionally, we carried out field surveys among local residents and health services to obtain additional data which allowed us to identify new locations for this species.

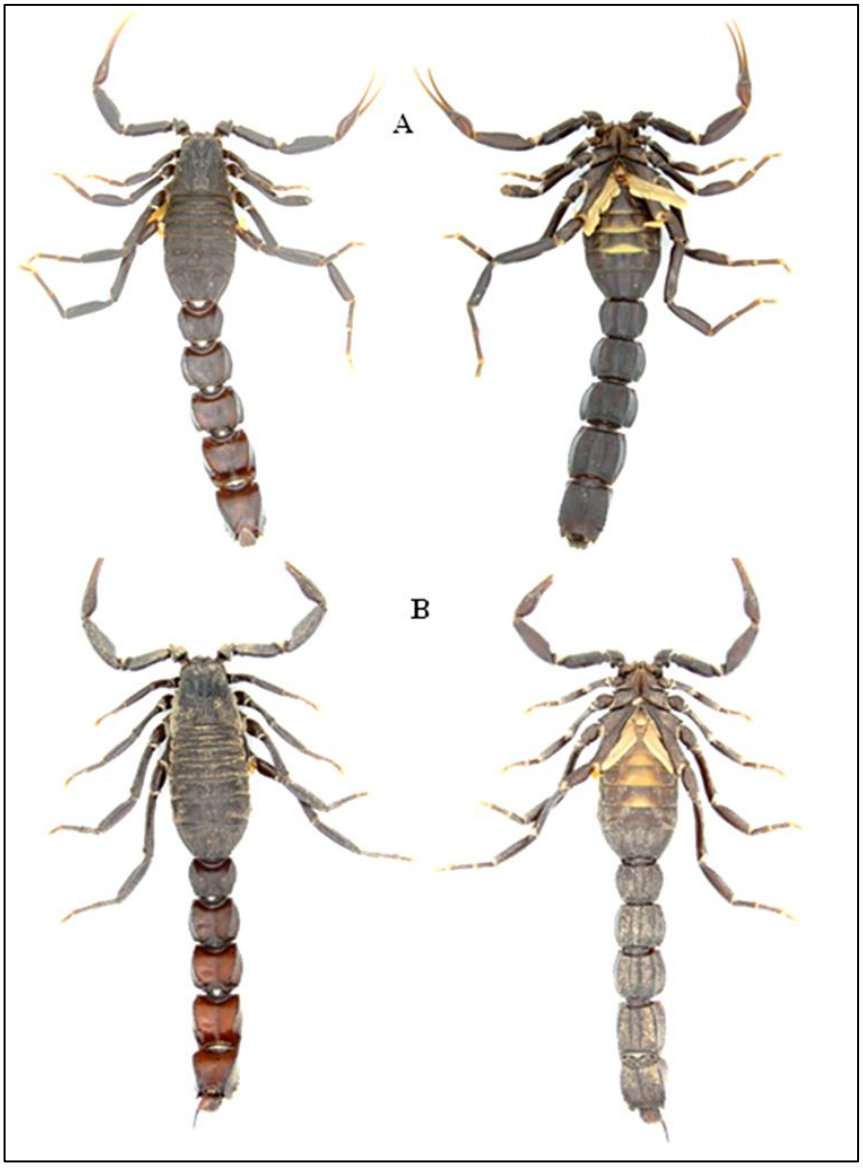

Fig. 2. *Androctonus aeneas* adult, dorsal and ventral views. A. ♂. B. ♀.

Scorpion identification

The specimens were killed and kept in 96% alcohol (ethanol). Identification was obtained using a stereo-microscope to highlight the distinctive and specific characteristics of the species (Fig. 2) according to the criteria established by Vachon (1952, 1974).

Results and Discussion

Systematic position

Family **Buthidae** C.L. Koch, 1837
Genus ***Androctnus*** Ehrenberg, 1828
Androctonus aeneas C.L. Koch, 1839 (fig. 3)
Syn. ***Androctonus turieli*** Teruel & Kovařík, 2014

Fig. 3. *Androctonus aeneas* C.L. Koch, 1839 in its biotope. A. adult. B. juvenile.

Material of *Androctonus aeneas* from Algeria cited by Vachon (1952)

Chellala and Tiaret, January 1930 (coll. IPA, Dr. ALQUIER), 2♂♂ ad., 3♀♀ ad.; **Messad**, coll IPA, 2♂♂, 8♀♀; **Taguine**, coll. IPA, 8♀♀, 3♂♂; **Zenina** (currently El-Idrissia located at. Djelfa), coll. IPA, 2♂♂, 6♀♀; **Ouled Djellal**, coll. IPA, 4♂♂; **Ghardaïa**, coll. LS, n° 109, Oct. 1924 (Dr. DESANGLES), 1♀ det. *Aeneas* by H. FOLEY; **Laghouat**, coll. MNP, 1899 (P. SECQUES), 1♀ im. det. *Aeneas* by E. SIMON = *bicolor* par KRAEPELIN with mention: passing to *crassicauda*; **Bou Sâada**, coll. MNP, 5♂♂, 5♀♀, det. *Aeneas* by E. SIMON; **Ouargla**, coll. MNP, 1885 (M. LECHATELIER), 1♂ ad. det. *Aeneas* by E. SIMON and *crassicauda* by KRAEPELIN. **Oran**, coll. MNP, 1887 (COQUEROL leg.), 1♀ im. det. *Aeneas* by E. SIMON et *crassicauda* by KRAEPELIN.

Recent material

The material cited in recent publications, also the new observation points, is summarized in Table (1).

Table 1. New observation points of *Androctonus aeneas* in Algeria.

Province	Region	Latitude	Longitude	Altitude (m)	Biotopes	References/ collectors
Recent literature						
Batna	Hidoussa	35°32'N.	05°55'E.	1633	Open Forest	Sadine *et al.*, 2015
Batna	Fesdis	35°37'N.	06°10'E.	1230	Matorrals	Sadine *et al.*, 2015

Khenchela	Khenchela	35°17'N.	07°07'E.	1134	Uncultivated plain	Meddour *et al.*, 2017
Tébessa	Safsaf El Ouesra	34°57'N.	08°12'E.	928	Agricultural plain	Abidi, 2022
Tébessa	Bir el-Ater	08°02'E.	34°44'N.	897	Natural	Abidi, 2022
Biskra	El Ghrous	34°43'N.	05°15'E.	176	Palm grove	Sadine *et al.*, 2015
El Oued	Ben Guecha	34°12'N.	07°36'E.	25	Palm grove	Sadine *et al.*, 2015
Sidi Bel Abbès	Marhoum	34°24'N.	00°18'O.	1134	Stony plain	Ouici *et al*., 2020
Sidi Bel Abbès	Marhoum	34°14'N.	00°15'O.	1061	Stony plain	Ouici *et al*., 2020
Tiaret	Sidi Abderrahmane	34°37'N.	00°55'E.	1002	Plowed steppe	Ait Hammou *et al*., 2023
Tiaret	Sidi Abderrahmane	34°45'N.	01°04'E.	1091	Plowed steppe	Ait Hammou *et al*., 2023
Tiaret	Madna	34°42'N.	00°59'E.	1028	Agricultural plain	Ait Hammou *et al*., 2023
Tiaret	Medrissa	34°52'N.	01°14'E.	1100	Natural	Ait Hammou *et al*., 2023
Tiaret	Ksar Chellala	35°13'N.	02°16'E.	826	Uncultivated plain	Ait Hammou *et al*., 2023
Tiaret	Zmalet Emir AEK	34°57'N.	02°22'E.	802	Natural	Ait Hammou *et al*., 2023
Tiaret	Faidja	35°06'N.	01°42'E.	1233	Agricultural plain	Ait Hammou *et al*., 2023
Tiaret	Naima	34°34'N.	01°45'E.	1026	Stony plain	Ait Hammou *et al*., 2023
Tiaret	Naima	34°59'N.	01°30'E.	1224	Stony plain	Ait Hammou *et al*., 2023
Tiaret	Ain D'heb	34°55'N.	01°31'E.	1156	Herbaceous layer of Alfa	Ait Hammou *et al*., 2023
Tiaret	Ain Dehab	34°55'N.	01°31'E.	1141	Uncultivated plain	Ait Hammou *et al*., 2023
Tiaret	Si Abdelghani	35°16'N.	01°36'E.	990	Uncultivated plain	Ait Hammou *et al*., 2023
Tiaret	Naima	34°34'N.	01°45'E.	1026	Stony plain	Ait Hammou *et al*., 2023
Tiaret	Rechaiga	35°22'N.	02°08'E.	876	Agricultural plain	Ait Hammou *et al*., 2023
Tiaret	Chehaima	34°26'N.	01°13'E.	1028	Uncultivated plain	Ait Hammou *et al*., 2023
Tiaret	Chehaima	34°23'N.	01°13'E.	1036	Uncultivated plain	Ait Hammou *et al*., 2023
New observation points						
Sétif	Guidjel	36°01'N.	05°25'E.	960	Open Forest	Rebbas, 2024
M'sila	Maarif	35°23'N.	04°15'O.	422	Steppe	Rebbas, 2023
M'sila	Baniou	35°24'N.	04°19'E.	401	Uncultivated plain	Rebbas, 2023
M'sila	Mergueb (Slim)	35°00'N.	03°48'E.	1010	Uncultivated plain.	Rebbas, 2023
M'sila	M'Cif	35°20'N.	04°52'E.	437	Stony plain	Rebbas, 2023
Sidi Bel Abbès	Marhoum	34°22'N.	00°50'O.	1200	Stony plain	El Bouhissi, 2020
Sidi Bel Abbès	Merine	34°48'N.	00°22'O.	1011	Aleppo Pine Forest	El Bouhissi, 2020
Sidi Bel Abbès	Ain Adden	35°17'N.	00°13'O.	714	Clear maquis	El Bouhissi, 2024
Sidi Bel Abbès	Rdjem Demouch	34°22'N.	00°50'O.	1197	Stony plain	El Bouhissi, 2024
Sidi Bel Abbès	Marhoum	34°16'N.	00°02'O.	1037	Uncultivated plain	El Bouhissi, 2024
Ain Temouchent	Sassel	35°03'N.	01°11'O.	366	Degraded maquis	Megharbi, 2024
Djelfa	Hassi fdoul	35°26'N.	02°15'E.	794	Stony ground	Ait Hammou, 2024
Tlemcen	El Aricha	34°19'N.	01°13'O.	1068	Steppe	Ziani, 2024
Djelfa	Hassi fdoul	35°29'N.	02°10'E.	903	Stony ground	Ait Hammou, 2024
Tiaret	Sougueur	35°09'N.	01°27'E.	1196	Agricultural plain	Ait Hammou, 2024
Tiaret	Mahdia	35°25'N.	01°43'E.	921	Agricultural plain	Chelghoum, 2024
Tiaret	Hamadia	35°33'N.	01°49'E.	816	Agricultural plain	Ait Hammou, 2024
Tissemsilt	Layoune	35°39'N.	02°00'E.	864	Stony plain	Cheddad, 2024
Tissemsilt	Layoune	35°38'N.	02°01'E.	827	Plowed steppe	Cheddad, 2024
Tissemsilt	Douar Essaid	35°34'N.	01°44'E.	910	Uncultivated plain	Feghoul, 2024
Tissemsilt	Boumengouch	35°35'N.	01°53'E.	878	Agricultural plain	Feghoul, 2024
Tissemsilt	Selmana	35°35'N.	02°05'E.	831.2	Uncultivated plain	Dahmani, 2024
Tissemsilt	Selmana	35°34'N.	02°08'E.	872	Almond Orchard	Ait Hammou, 2024
El Bayadh	Sidi Taifour	33°40'N.	01°40'E.	1139.3	Uncultivated plain	Bakel, 2024
El Bayadh	Boualem	33°44'N.	01°36'E.	1311	Stony plain	Bakel, 2024
Saïda	Aïn El Hadjar	34°49'N.	00°09'O.	833	Stony plain.	Ait Hammou, 2023
Aflou	Aflou	34°03'N.	02°02'E.	1432	Uncultivated plain	Ait Hammou, 2023
Aflou	Aflou	34°11'N.	02°02'E.	1298	Stony plain	Ait Hammou, 2023
Aflou	Sebgag	33°59'N.	01°55'E.	1406	Uncultivated plain	Ait Hammou, 2024
Djelfa	Hassi Fdhoul	35°26'N.	02°17'E.	774	Stony plain	Ait Hammou, 2024
Naâma	Naâma	33°15'N.	00°18'O.	1173	Aleppo pine Forest	Ait Hammou, 2024
Bechar	Beni Ounif	32°08'N	01°00'W	1023	Uncultivated plain.	El Bouhissi, 2022
Ghardaïa	Berriane	32°51'N.	03°43'E.	600	Palm grove	Sadine, 2014

Several authors reported that the taxonomic status of several species in the genus *Androctonus* remains very uncertain (Fet *et al.*, 2000; Lourenço, 2005). Vachon (1952) noticed that *A. aeneas* is a morphologically "plastic" species with many varieties that are difficult to classify. However, according to Lourenço *et al*. (2015), *A. aeneas* remains a well-defined and valid species, described as the largest black species of the genus *Androctonus* in Algeria (Sadine *et al*., 2020). Its distribution in Algeria is over a wide area from Tunisia to the Algerian high plateaus (Lourenço *et al.*, 2015; Meddour *et al.*, 2017; Sadine, 2018; Mekahlia *et al*., 2021).

This species has a significant ecological plasticity, because it has been found in various biotopes such as: the steppes (Vachon, 1952; Chichi, 2015; Ouici *et al*., 2020), in forest and herbaceous habitats and rocky areas (Sadine *et al*., 2012; Meddour *et al*., 2017; Ouici *et al*., 2020; Mekahlia *et al*., 2021), as well as in the Sahara Regs and palm groves (Sadine *et al*., 2011, 2012, 2014; Sadine & Bissati, 2014). According to our recent observations, this species is primarily concentrated in steppe biotopes, particularly in flat lands with sandy limestone soils where shelters are abundant. It is also found in uncultivated plains, stony plains offering numerous shelters, as well as in plowed and abandoned steppe soils, areas with *Lygeum spartum*, herbaceous layer of Alfa and *Artemisia*, abandoned farms and overgrazed Alfa steppe (Fig. 2). Its presence has been noted near farms and urban areas, probably due to the abundance of various preys (Feghoul & Benali, 2022).

Based on results of Table (1), we deduce that *A. aeneas* can be adapted to an altitude ranging from 25 m to 1633 m. Although, Ouici *et al*. (2020) found this species in steppes and forests at an altitude exceeding 700 m in north western Algeria. Sadine *et al*. (2012) reported that in the Belzma-Batna region (eastern Algeria), the abundance of *A. aeneas* is negatively correlated with a dense forest vegetation and altitude, which influence the climatic conditions. Lourenço *et al.* (2015) and Sadine (2018) stated that the abundance of *A. aeneas* decreased with the density of forest vegetation and altitude as well as in the Algerian Sahara.

The new observations are mostly located in the predicted geographical distribution zone for this species by Lourenço *et al*. (2015) and Sadine (2018), with the exception of the new records from Aïn Témouchent, Sabdou, El Bayadh, and Saïda, which are situated in the west and southwest towards Naâma and Béchar. It is also important to highlight its presence in the Tiaret region (Ait Hammou *et al*., 2023), which is qualified at steppe with semi-arid climate, as well as in Sidi Bel Abbès (North western Algeria).

Additionally, the species has also been observed in the southern part of Tissemsilt, in a steppe area bordering Djelfa and Media, where the presence of *A. aeneas* had already been reported by Vachon (1952) and confirmed in the present work. Recently, one more observation in the region of Sétif, which confirms the north-western limit of its distribution range in Algeria.

Therefore, the distribution map of *A. aeneas* drawn up by Lourenço *et al.* (2015) and Sadine (2018) must be updated in a way that this species occupies the central horizontal band, extending from Tébessa in the East, passing through Batna in the Belezma Mountains, at an altitude varying between 800 and 1000 m, to Naâma in the West. Thus, the current distribution of this species in Algeria can be summarized in Fig. (4).

The information presented in this work, can allow us to better understanding of the habits, ecology, and geographical distribution limits of this species in Algeria noting also that the updating of the distribution indicates that this species frequents several

biotopes, previously unknown, allow us to understand and define the risk areas in terms of scorpion envenomation by this potentially dangerous species.

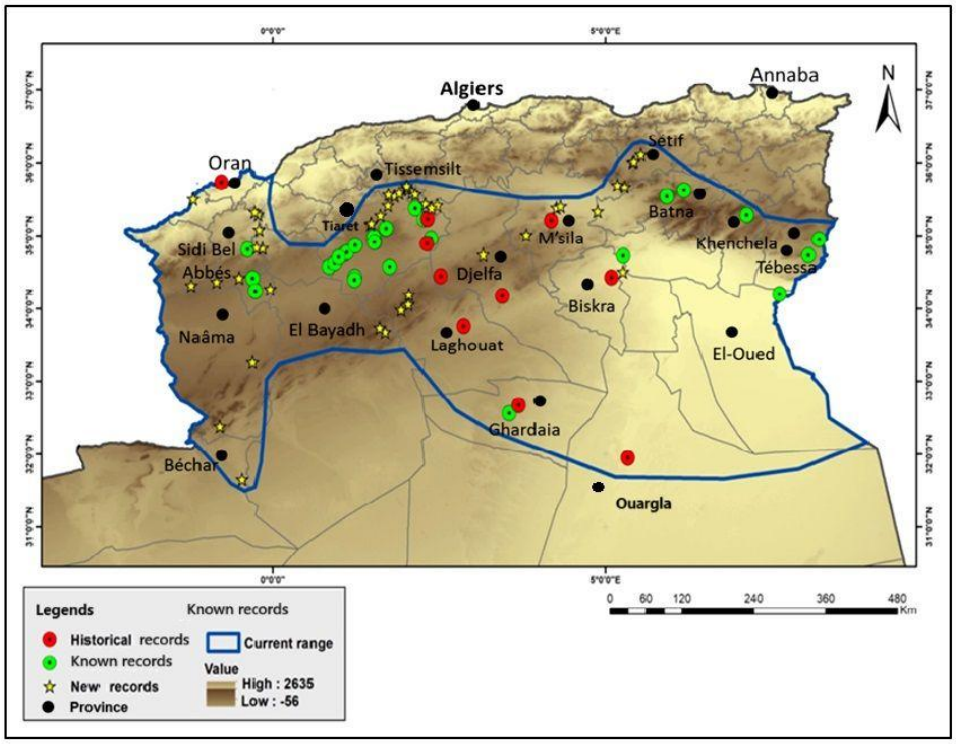

Fig. 4. Map of current geographical distribution range of *Androctonus aeneas* in Algeria.

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External morphological assessment of tarsal sensilla on the forelegs of solifuges (Arachnida: Solifugae)

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Abstract

The external morphology and distribution of the tarsal sensilla and other epicuticular structures on 1st pair of legs of five species from five different families of solifuges were examined using scanning electron microscopy: *Gluviopsilla discolor* (Kraepelin, 1899) (Daesiidae), *Galeodes toelgi* Werner, 1922 (Galeodidae), *Gylippus (Paragylippus) hakkaricus* Erdek, 2019 (Gylippidae), *Karschia (Karschia) mastigofera* Birula, 1890 (Karschiidae), *Rhagoderma tricolor* Roewer, 1941 (Rhagodidae). The many forms of setae, sensilla, and epicuticular protrusions were characterised, as well as the potential mechanoreceptors and chemoreceptors activities.

Keywords: Solifugae, forelegs, sensilla, mechanoreceptors, chemoreceptors.

Introduction

Only a few investigations have been conducted to determine the functional importance of morphological structures specific to solifuges (Cushing & Custo, 2012). The first pair of legs particularly require morphological investigation. Punzo (1998) indicated the first pair of legs are generally reduced in size and act primarily as tactile organ. The first pair of legs has lost its ambulatory ability. They are typically composed of seven segments and mostly serve as supplementary sensory components. The length might vary greatly depending on the genus or species. Vestigial claws at the distal end are present in some species, indicating an earlier ambulatory function during evolution (Manton, 1977; Punzo, 1998). Bertkau (1892) defined two types of sunken sensilla on the

Fig. 1. The habitus of species: a. ♂ *Karschia (Karschia) mastigofera* Birula, 1890. b. ♀ *Gluviopsilla discolor* (Kraepelin, 1899). c. ♀ *Gylippus (Paragylippus) hakkaricus* Erdek, 2019. d. ♀ *Galeodes toelgi* Werner, 1922. e. ♂ *Rhagoderma tricolor* Roewer, 1941. (Scale bars: 1 cm).

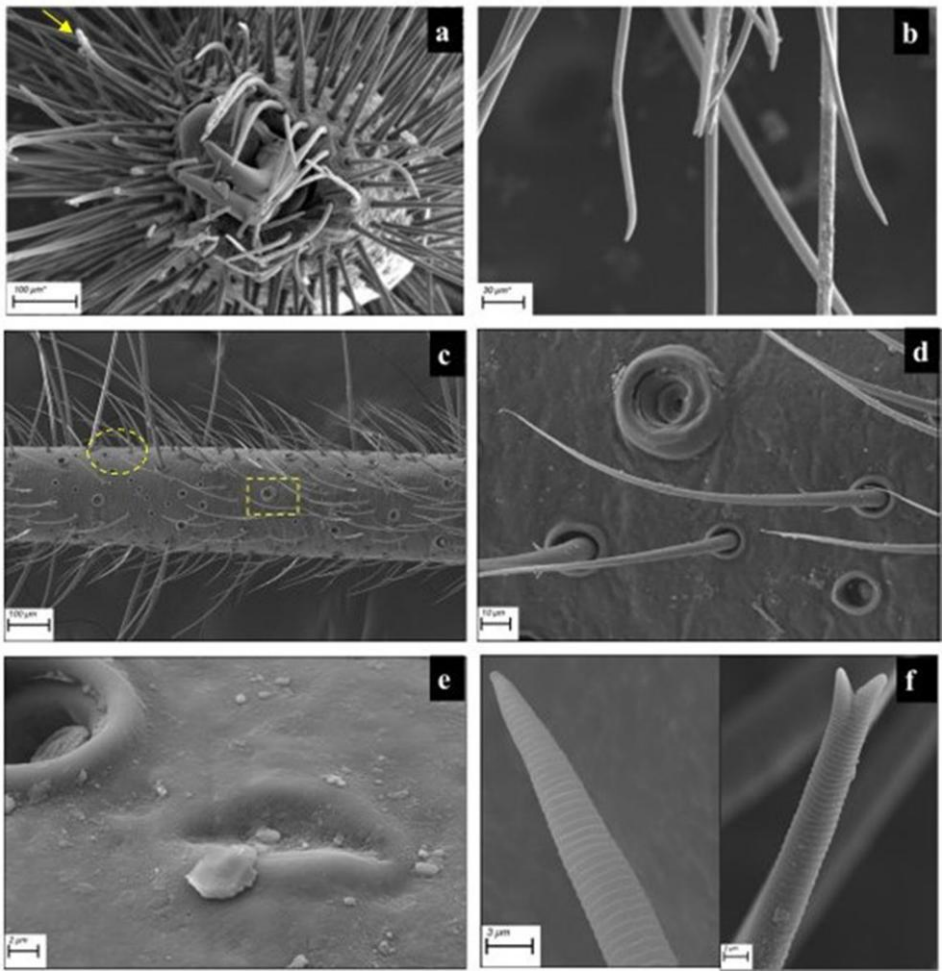

Fig. 2. ♂ *Karschia (Karschia) mastigofera* Birula, 1980 a. Tarsus tip of the dextral first leg with tarsal claws (The arrow shows knobbed seta). b. The filiform and bifurcated setae on lateral surface of tarsus. c. Metatarsal surface of first leg (The circle shows a single slit structure and the square shows the socket structure). d. The filiform setae branched at base on metatarsal surface. e. A single slit sensillum on metatarsal surface. f. The tarsal filiform and bifurcate setae in detail.
(Scale bars: a,c = 100, b = 30, d = 10, e = 2, f = 3, 2 µm).

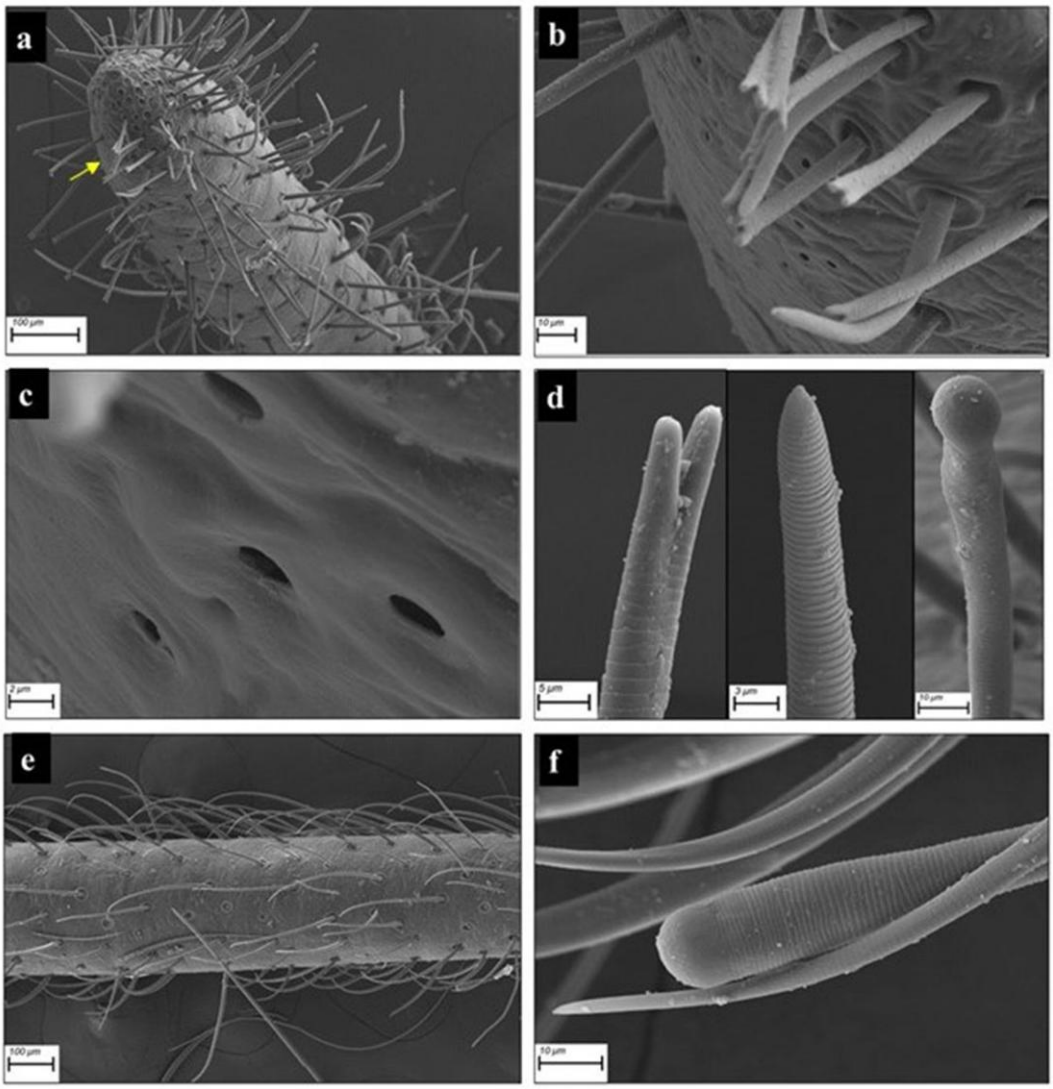

Fig. 3. ♀ *Gluviopsilla discolor* (Kraepelin, 1899) a. Tarsus tip of the dextral first leg (arrow shows tarsal pore field). b. The filiform, bifurcated, and knobbed setae on lateral surface of tarsus and tarsal pore fields on prodorsal surface of tarsus. c. The tarsal pores in detail. d. The filiform, bifurcated, and knobbed setae in detail. e. Metatarsal surface of first leg. f. Knobbed seta and filiform seta on tarsus in detail.
(Scale bars: a,e = 100, b,f = 10, c = 2, d = 5, 3, 10 µm).

tarsal segments of the pedipalps and first pair of legs as "flaschenförmige Organe" and "champagnerpfropen-förmige" using. These sense organs were thought to be olfactory receptors based only on behavioural data as *Sensilla ampullacea*. It is also observed that the male *Othoes saharae* Panouse, 1960 began to bite the female with his chelicerae while rotating her body with his forelegs and tapping her with his pedipalp during courtship and mating (Junqua, 1966). Muma (1966a) studied the burrowing habits of North American solifuges and discovered that plowing behaviour involved lowering the body to place the chelicerae at or near the base of the pile, flexing the palpi and first legs on each side of the pile to prevent lateral scatter, and pushing the pile like a bulldozer or road-grader. Muma (1966b) reported that during the attack phase of mating of *Eremobates* species, both sexes lift the palps and the first pair of legs, open the chelicerae, and move the body back and forth from front to back on the remaining three leg pairs. Punzo (1994) indicated that *Eremobates mormonus* (Roewer, 1934) responds

quickly to tactile stimuli as well as any locomotor activity of the prey, especially upon contact with the pedipalps or legs alleging that tactile stimuli are more important than chemical cues in the location of prey for this species.

This study aimed to conduct a preliminary survey of the setae and other possible sensory structures found on the first pair of legs of 5 species representing each of the five families distributed in Türkiye.

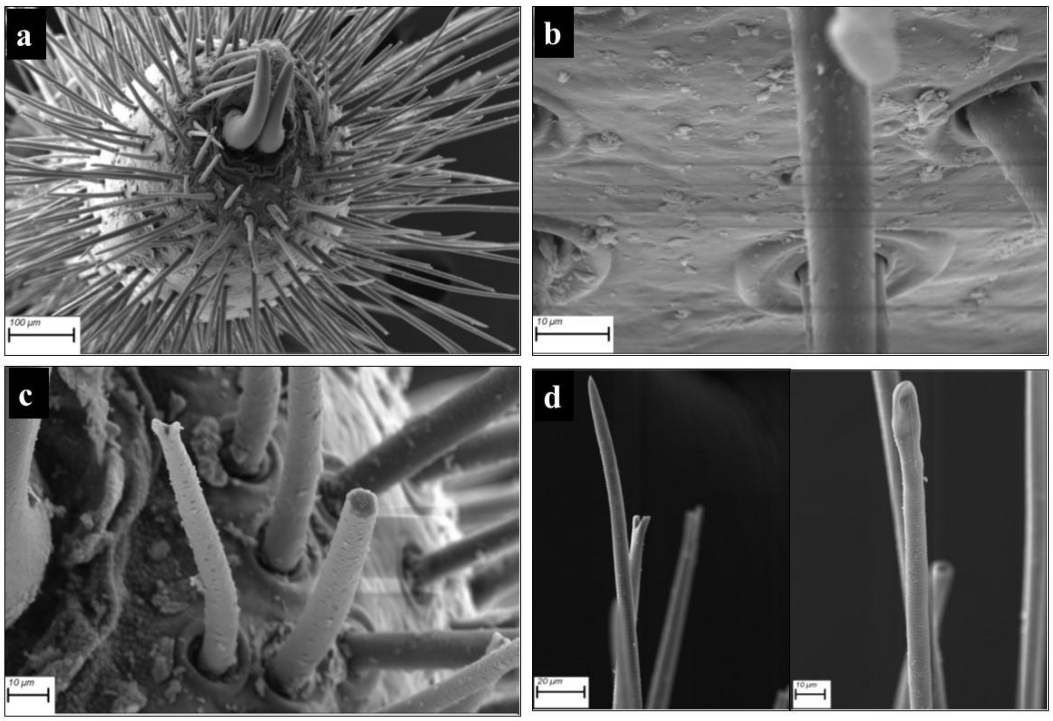

Fig. 4. ♀ *Gylippus (Paragylippus) hakkaricus* Erdek, 2019 a. Tarsus tip of the dextral first leg with tarsal claws. b. Tarsal surface with a pore and socket structures. c. The bifurcated seta on tarsal tip. d. The filiform and knobbed setae.
(Scale bars: a = 100, b,c = 10, d = 20,10 µm).

Material & Methods

Examined Material. 1- Family Daesiidae: *Gluviopsilla discolor* (Kraepelin, 1899), 1 female, Hakkari Prov., Central District, Hakkari University Campus, 37°34’25”N, 43°45’13”E, 1724 m a.s.l., 12.09.2023, leg. M. Erdek. 2- Family Galeodidae: *Galeodes toelgi* Werner, 1922, 1 female, Hakkari Prov., Yüksekova District, Yürekli Village, 37°26’09.50”N, 44°21’54.10”E, 2105 m a.s.l., 10.07.2020, leg. T. Koca. 3- Family Gylippidae: *Gylippus (Paragylippus) hakkaricus* Erdek, 2019, 1 female, Hakkari Prov., Berçelan Plateau Road, 9 km South of downtown Hakkari, 37°36’39”N, 43°44’39”E, 2290 m a.s.l., 21.05.2023, leg. M. Erdek. 4- Family Karschiidae: *Karschia (Karschia) mastigofera* Birula, 1890, 1 male, Iğdır, Central District, Melekli Village, 5 km SE, 39°55’00”N, 44°08’15”E, 899 m a.s.l., 27.08.2022, leg. E.A. Yağmur & Ö. Sipahioğlu. 5- Family Rhagodidae: *Rhagoderma tricolor* Roewer, 1941, 1 male, Gaziantep Prov., Oğuzeli Dist., 2 km South of Çaybaşı Vill., 36°59’58”N, 37°30’48”E, c. 750 m a.s.l., 23.08.2017–3.08.2018, leg. E.A. Yağmur & M. Özkörük.

For Scanning Electron Microscopy (SEM), specimens' tarsi were immersed in 99.9% ethanol overnight. Following dehydration, the specimens were gold-coated using a Quorum SC7620 sputter coater. Morphological structures were analysed and

photographed using a ZEISS Sigma 300 scanning electron microscope at Van Yüzüncü Yıl University's Science Application and Research Centre in Van, Türkiye, using a 10kV accelerating voltage.

Results

The general appearance of the solifuges used is as in Fig. (1a-e). Except for the species belonging to family Daesiidae (Fig. 3a), species belonging to other families examined have a pair of claws at the tarsus ends of their forelegs (Figs. 2a, 4a, 5a-b, 6a). Except for *Gluviopsilla discolor*, other species have tarsal claw and arolium structures. In these species, the first 2-3 rows of setae at the tip of the tarsus are bent wedge-shaped onto these structures (Figs. 2a, 4a, 5a, 6a). These setae are shed in these setae are shed in *Gluviopsilla discolor* (Fig. 3a). There are also many thin long setae (2b, 3a, 4a, 5a, 6a) and falciform hairs on the tarsus surface.

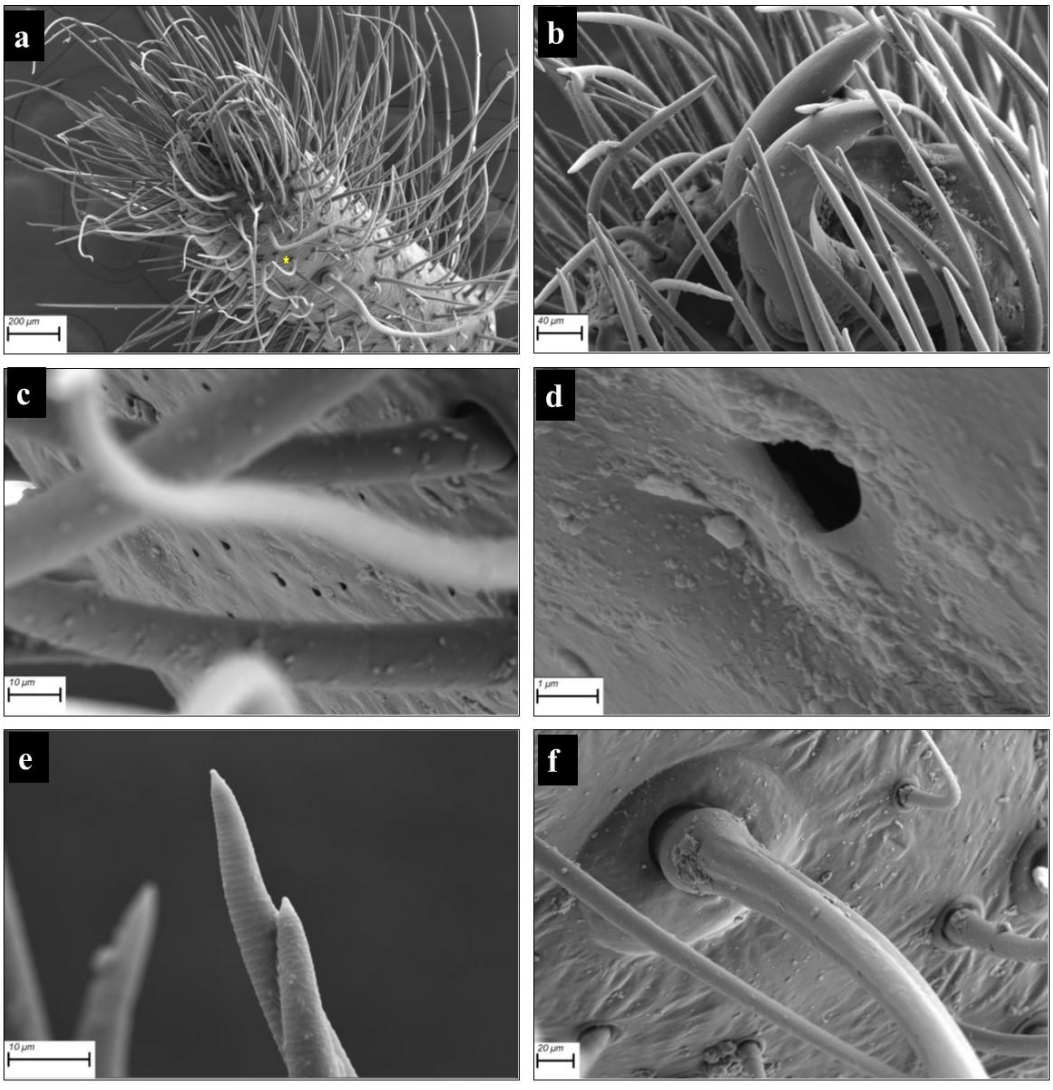

Fig. 5. ♀ *Galeodes toelgi* Werner, 1922 a. Tarsus tip of the dextral first leg with tarsal claws (The asterisk shows pore field). b. Tarsal claws in detail. c. The tarsal pore fields on prolateral surface of tarsus. d. A single tarsal pore in detail. e. The tips of filiform setae on tarsus. f. The socket structures in different sizes.
(Scale bars: a = 200, b = 40, c, e = 10, d = 1, f = 20 µm).

Three different types of setae were detected around the tarsus tip of the different families and species examined: filiform seta (Figs. 2b,f, 3b,d,f, 4d, 5b,e, 6d,f), bifurcated seta (Figs. 2b,f, 3b,d) and knobbed seta (Figs. 3d,f, 4d). These setae are typically in the form of *Sensilla trichodea*; as thin, aporous, and with flexible sockets and annular cuticular setal surfaces (Figs. 2f, 3d,f, 4c, 5e, 6d,f). Only in the species *Rhagoderma tricolor*, especially at the tip of the tarsus, there are the filiform and bifurcated setae: short, blunt and particularly narrowly socketed (Fig. 6d). Knobbed setae types with three different morphologies, two of which are *Gluviopsilla discolor* (Figs. 3d,f) type and one of which is *Gylippus (P.) hakkaricus* (Fig. 4d) type, were identified. *Galeodes toelgi* is a highly setaceous species and has setae of different lengths on the tarsus surface. The shortest of these are the falciform setae (approximately 40 μm) and the longest are the setae in the form of *Sensilla chaetica*, which are inflexible, and have a grooved surface, with narrow sockets, and are swollen near the socket (approximately 800 μm). In some species, small, irregular clusters of pores were observed on the prodorsal surface of the tarsus. The cuticular surface where these pore fields (are located with no setal structures and smooth (Figs. 3a-c, 4b, 5a,c-d, 6a-c).

Metatarsal cuticular surface morphology varies among species. In the species *Karschia (K.) mastigofera*, there are setae in the form of serrated, inflexible, aporous *Sensilla chaetica*, which have wide and intertwined stepped socket structure, specialized as very long tactile hairs perpendicular to the surface on the surface of the metatarsus. In addition, the thinner structure on the metatarsus surface has filiform setae in the form of *Sensilla trichodea*, which show short branching extensions in part close to the socket. The socket structure is simpler and the setae form an angle of approximately 45 degrees to the cuticular surface. Additionally, single slit sensilla with prominent cuticular lips are observed at irregular intervals on the metatarsal surface of this species. (Figs. 2c-d). In *Gluviopsilla discolor*, the metatarsus surface is covered with thin, mobile setae of different lengths in the form of *Sensilla trichodea*, and the socket structure is not very obvious (Fig. 3e). In *Rhagoderma tricolor*, the metatarsal setae are in the form of *Sensilla chaetica* and extend distally towards the cuticle surface at an angle of less than 45 degrees. The seta base is wide towards the socket and has the same dimensions as the socket. Since the socket structure is not very wide, it is not flexible and does not allow movement (Fig. 6e).

Discussion

The distribution and structure of several tarsal and metatarsal surfaces of forelegs as well as sensilla in five solifuges of different families, *Galeodes toelgi, Gluviopsilla discolor, Gylippus (Paragylippus) hakkaricus, Karschia (Karschia) mastigofera*, and *Rhagoderma tricolor*, were the main topics of the current study. Solifugae have adapted, by losing the ability to move, their first set of legs and turning them into sensory structures. This has improved their capacity to perceive and react to environmental cues, which is essential for their survival in their particular environments.

The cuticular surfaces of all identified sensilla are aporous. McIver (1975) and Altner & Prillinger (1980) stated that aporous sensilla function as mechanoreceptors. It has been observed that the front legs, together with the pedipalps, are used to contact prey and the opposite sex in terrariums created in laboratory conditions [First author's personal observations on *Gylippus (Paragylippus) monoceros* Werner, 1905, *Galeodes araneoides* (Pallas, 1772), and *Galeodes hakkariensis* Erdek, 2021]. Muma (1966b) in his study on the mating behaviour of *Eremobates* states that during copulation, the male strokes the female's propeltidium and legs downward and outward with his pedipalps and

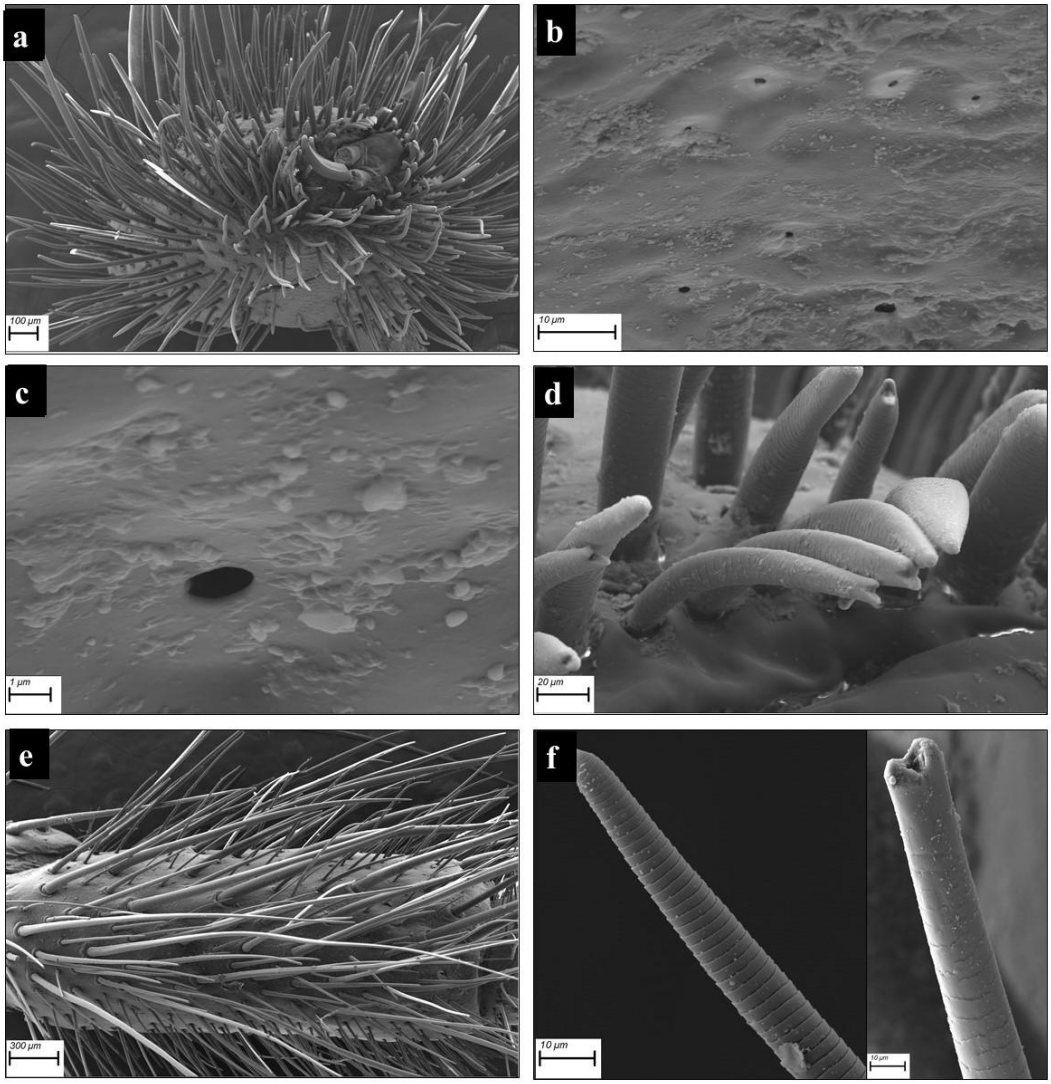

Fig. 6. ♂ *Rhagoderma tricolor* Roewer, 1941 a. Tarsus tip of the dextral first leg with tarsal claws. b. The tarsal pore fields on prolateral surface of tarsus. c. A single pore in detail. d. The setal complex series near arolium. e. Metatarsal surface of first leg. f. The filiform and bifurcated setae in detail.
(Scale bars: a = 100, b,f = 10, c = 1, d = 20, e = 300 µm).

first pair of legs, and that this behaviour, which continues for a while, results in the immobility of the female. This also shows that the first pair of legs does not have a walking function but rather functions as an accessory sensory organ, auxiliary to the pedipalps, both as a mechanoreceptor and a contact chemoreceptor. Erdek & Yiğit-Kayhan (2016) observed that the pedipalps and forelegs were used for tapping and sweeping the soil mound during burrowing behaviour in *Gylippus (G.) syriacus* (Simon, 1872). We think that the sensilla detected in the species examined may change again with the habitat preferred by the species such as impact-softness, density-rarity and are generally affected by climatic concepts. In fact, a species with a thinner sensilla structure such as *Gylippus (P.) hakkaricus* prefers higher, cooler, more humid and soft air; while a species with a harder and less flexible sensilla structure such as *Rhagoderma tricolor* prefers lower, more arid and dry soil habitats. The metatarsal and tarsal long trichoid sensilla on forelegs, used for detecting and first contact with prey and mate, must be functioned as contact chemoreceptors.

The pores located in the prodorsal part of the tarsus may secrete pheromones that highly probably create attraction between sexes or attract prey. This strengthens the possibility that pores function as chemoreceptors. Baran & Erdek (2022) also said that solifuges do not walk with their first pair of legs, but instead dig a tunnel by bending their tarsi and metatarsi inward. Tarsal pores cover the little portions on the retrodorsal surfaces of tarsi that lack sensilla in both sexes. They must be employed as chemoreceptors to detect odiferous stimuli like as mate, food, and habitat. The similar pore area was also detected in the apex of the pedipalp tarsus (Bauchhenss, 1983; Cushing & Casto, 2012; Yiğit *et al.*, 2012). Bauchhenss (1983) proposed that reducing the number of pores could be an adaptation to prevent water loss by evaporation. Cushing & Casto (2012) pointed out that although its function as an olfactory organ is assumed, it needs to be tested. Considering that the accessory limbs of pedipalps, the same assumptions are likely to apply to the forelegs.

The single slit sensillum as a small isolated slit was only demonstrated on the metatarsus surface of *Karchia (K.) mastigofera.* Slit sensilla are arachnids' specialised strain receptors, which enable knowledge of mechanical events occurring within the cuticle. As a result, slit sensilla serve as mechanoreceptors.

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First record of *Zodarion* from the *spinibarbe* group in Spain (Araneae: Zodariidae)

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Abstract

Zodarion sp. from the *spinibarbe* group has been newly recorded in Spain. Previously, this species group was only known from eastern Mediterranean countries. Therefore, its presence in Iberia represents the westernmost occurrence recorded for this group. Further details are discussed in this paper.

Keywords: Ant-eating spider, zodariid, introduced species, Mediterranean, Iberian Peninsula.

Introduction

The genus *Zodarion* Walckenaer, 1826, with over 170 species, is the second most speciose genus within the family Zodariidae Thorell, 1881 (World Spider Catalog, 2024). Although this genus is distributed in several continents, namely North America, Africa, Europe, and Asia (World Spider Catalog, 2024), the majority of its species occur in the Mediterranean basin (Bosmans, 1994; Bosmans & Draney, 2018). Currently, most *Zodarion* species are classified into 13 informal species groups, including *aculeatum*, *elegans*, *germanicum*, *graecum*, *italicum*, *lutipes*, *morosum*, *mostafai*, *pusio*, *rubidum*, *spinibarbe*, *styliferum*, and *thoni* (Benhalima & Bosmans, 2020; Bosmans, 1994, 1997, 2009; Pekár *et al*., 2003; Pekár & Cardoso, 2005; Pekár *et al*., 2011).

A new member of the genus *Zodarion*, belonging to the *spinibarbe* group, has been recorded for the first time in Spain. The *spinibarbe* group, comprising 14 species, was formerly known solely from the eastern Mediterranean (Bosmans, 2009; Coşar & Danişman, 2024). This study established Spain as the westernmost occurrence point of

the *spinibarbe* group. This discovery not only significantly extends the biogeographical range of the *spinibarbe* group and enriches the biodiversity knowledge of the Iberian Peninsula but also raises intriguing questions about the dispersal mechanisms underlying this finding.

Material and Methods

Specimens were examined using an Olympus SZ51 stereomicroscope. Digital photographs of the habitus and copulatory organ were captured with a KEYENCE VHX-5000 digital stereomicroscope. The endogyne structure was photographed after being macerated it in boiling 20% KOH until the soft tissue dissolved. Additionally, drawings of the epigyne were provided to emphasize critical structures that could not be easily recognized in digital images. All measurements are reported in millimetres. Carapace length and width, total body length, leg lengths, and eye sizes were measured on the dorsal side. The leg lengths are presented as follows: total (femur, patella, tibia, metatarsus, and tarsus). Morphological terminology follows Bosmans (2009). The specimens are deposited at the Department of Botany and Zoology, Masaryk University, Czech Republic (CMU). The distribution map is generated using SimpleMappr (Shorthouse, 2010). The following abbreviations are used in the text: ALE = anterior lateral eye, AME = anterior median eye, Cx = coxa, Fe = femur, PLE = posterior lateral eye, PME = posterior median eye.

Taxonomy

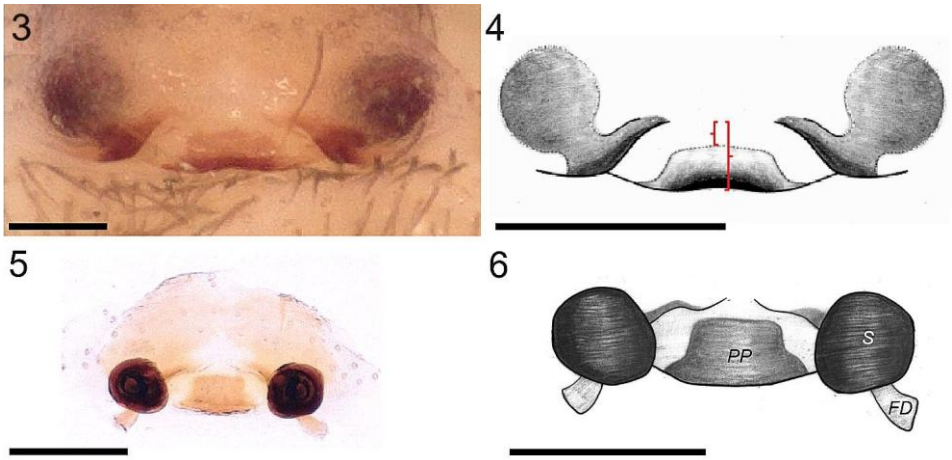
Family **Zodariidae** Thorell, 1881
Subfamily **Zodariinae** Simon, 1890
Genus ***Zodarion*** Walckenaer, 1826
Type species: ***Enyo nitida*** Savigny in Audouin, 1825
Genus diagnosis and species composition: See Bosmans (1994) and World Spider Catalog (2024).

The *spinibarbe* group and its species composition
Members of this group share the following characters: tibial apophysis often robust or (rarely) dagger-shaped, with or without a lateral hump and a terminal and/or a ventral tooth. Median apophysis inclined U-shaped or lamellar-shaped with one to three teeth. Tegulum with or without a preolateral bulge. Embolus with a broad base, slightly narrowing towards the tip, rarely bifid. Epigyne incised posteriorly, with or without a median hood and a posteromedian pouch. Spermathecae rounded, situating on sides of the incision and separated from each other by at least 1.2 their diameter.
Species included: *Zodarion barbarae* Bosmans, 2009, *Zodarion blagoevi* Bosmans, 2009, *Zodarion epirense* Bringoli, 1984, *Zodarion hauseri* Bringoli, 1984, *Zodarion karpathos* Bosmans, 2009, *Zodarion kossamos* Bosmans, 2009, *Zodarion noordami* Bosmans, 2009, *Zodarion ohridense* Wunderlich, 1973, *Zodarion spinibarbis* Wunderlich, 1973, *Zodarion van* Bosmans, 2009, *Zodarion vankeerorum* Bosmans, 2009, *Zodarion yigitakcai* Coşar & Danışman, 2024, *Zodarion zorba* Bosmans, 2009, and *Zodarion* sp.

***Zodarion* sp.**
Figs. 1-6.
Material examined. SPAIN: 1♀, 5 juv.; Sierra Nevada, Granada, Vereda de la Estrella; 27.V.2012; S. Pekár & S. Korenko leg.; CMU.

Figs. 1-2. *Zodarion* sp., female habitus. 1. dorsal view. 2. ventral view. [Each figure is a composite of two separate images] (Scale bar: 1 mm).

Comment. These representatives have been included in this study without specifying their formal taxonomic rank due to two main reasons: (1) the lack of additional material from both sexes to confirm their taxonomic status, and (2) significant differences observed in this ambiguous material compared to *Z. blagoevi* and *Z. zorba*.
Diagnosis. These female specimens are most closely related to those of *Z. blagoevi* and *Z. zorba* based on the general morphology of the epigyne, but they can be distinguished from both species by: (1) a larger prosoma length (2.87 in *Zodarion* sp. vs. 1.62 in *Z. blagoevi* and 1.42 in *Z. zorba*), (2) the height of the anterior pale region of epigyne to the height of epigynal plate ratio (0.41 in *Zodarion* sp. vs. 0.15 in *Z. blagoevi* and 0.26 in *Z. zorba*, cf. (Figs. 3-4) and figs. 140, 166 in Bosmans, 2009), (3) a broadened, trapezoidal posteromedian pouch of epigyne (vs. dome-shaped in both other species, cf. Figs. 3-4 and figs. 140, 166 in Bosmans, 2009), (4) spermathecae separated by 1.7 their diameter (vs. separated by twice their diameter in both other species, cf. (Figs. 5-6) and figs. 141, 167 in Bosmans, 2009).



Figs. 3-6. *Zodarion* sp. female copulatory organ (CMU). 3-4. epigyne, ventral view. 5-6. endogyne, ventral view. Abbreviations: FD = fertilization duct, PP = posteromedian pouch, S = spermatheca. (Scale bars: 0.2 mm).

Description. Female. Total length 4.57 mm, carapace 2.87 mm long, 2.2 mm wide. Prosoma (Figs. 1-2): Carapace, clypeus and chelicerae light brown; mouthparts basally, sternum and palps yellowish-brown, mouthparts apically pale. Eyes: AME 0.1, ALE = PME 0.08, PLE 0.058, AME-AME 0.02, ALE-ALE 0.24, PME-PME 0.25, PLE-PLE 0.19. Opisthosoma (Figs. 1-2): Abdomen dorsum uniformly dark brown, with no pattern, ventrally whitish. Spinnerets whitish. Legs: Cx and Fe of all legs yellowish-brown; other leg segments missing. Femur length: (0.97, 0.99, 1.03, 1.17). Epigyne (Figs. 3-6): Epigynal plate trapezoidal, significantly wider than long. Epigyne antero-laterally limited by a pair of sutures not reaching each other, the external parts of sutures finely sclerotized. Epigyne also accompanied by a broad, trapezoidal posteromedian pouch. Endogyne with large, globular spermathecae on both sides of the epigynal plate. Spermathecae separated by 1.7 their diameter.
Male. Unknown.
Distribution. Only known from a single locality in southern Spain (Fig. 7).

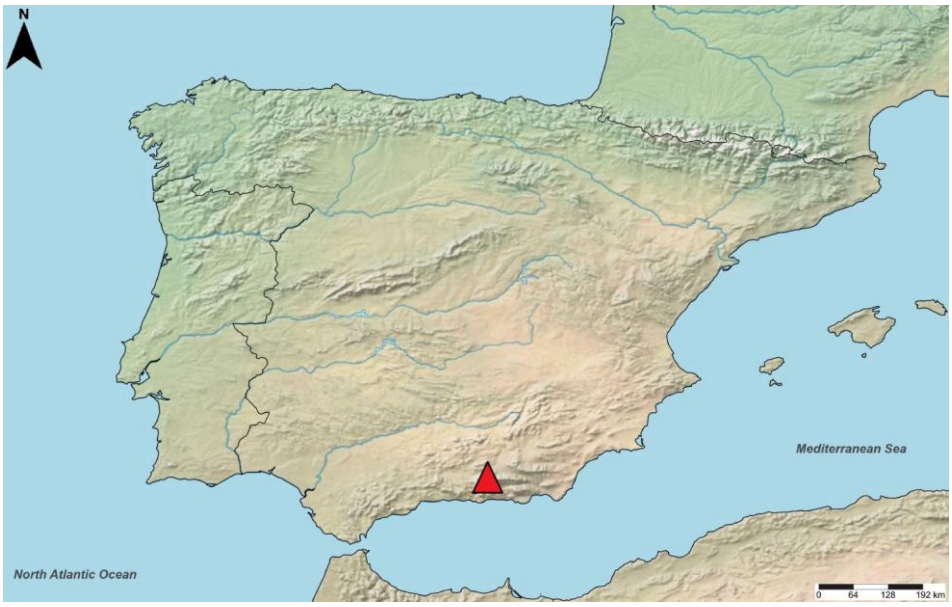


Fig. 7. Distribution map of *Zodarion* sp. (Red triangle)

Discussion

Although Mediterranean *Zodarion* species have been well studied (Benhalima & Bosmans, 2020; Bosmans, 1994, 1997, 2009; Coşar, 2021a, 2021b; Coşar & Danişman, 2021, 2024; Coşar, Danişman & Elverici, 2022; Coşar, Danişman & Kunt, 2022; Coşar *et al*., 2021; Danişman & Coşar, 2020, 2021; Danişman *et al*., 2017; Pekár *et al*., 2003; Pekár & Cardoso, 2005; Pekár *et al*., 2011), ongoing exploration in this region continues to yield new findings. *Zodarion* spiders are primarily noted for their limited distribution areas (Bosmans & Draney, 2018), and the existence of at least 140 endemic and sub-endemic species in the Mediterranean region indicates their high rates of speciation (World Spider Catalog, 2024). However, there are a few notable exceptions indicating recent range extensions, such as *Zodarion rubidum* Simon, 1914, and *Z. italicum* (Canestrini, 1868). *Z. rubidum* has spread beyond Europe, to Asia and America (World Spider Catalog, 2024). Bosmans & Draney (2018) hypothesized that climate directly affects the expansion of this species. On the other hand, the widespread observation of *Z. rubidum* along European railway networks suggests another hypothesis that the species

has extensively propagated across Europe and possibly western Asia via railway systems. Active railroads not only provide shelter for *Zodarion* during cold seasons but also facilitate its spontaneous dispersal.

Regarding *Zodarion* sp., a new Iberian member of the *spinibarbe* group, it remains unclear whether it is a newly discovered native Spanish species or an introduced species into a new habitat. Further investigation is necessary to resolve this question.

Acknowledgment

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First record of *Spheropistha melanosoma* Yaginuma, 1957 (Araneae: Theridiidae: Argyrodinae) from China, with a new combination

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Abstract

A new record species from China is proposed: *Spheropistha melanosoma* Yaginuma, 1957, based on specimens collected from Guanshan National Nature Reserve of Jiangxi Province. A new combination is proposed: *Spheropistha incursus* (Gray & Anderson, 1989) **comb. nov.** is transferred from the genus *Argyrodes* Simon, 1864.

Keywords: Taxonomy, biodiversity, morphology, cobweb spiders, Theridiidae.

Introduction

Spheropistha Yaginuma, 1957 is a small genus of the subfamily Argyrodinae Simon, 1894 with seven known species, four of which have been recorded in China (World Spider Catalog, 2024). Levi and Levi (1962) transferred this genus to the family Theridiosomatidae Simon, 1881, but Brignoli (1981) rejected this combination. Tanikawa (1998) considered this genus as a junior synonym of *Argyrodes* Simon, 1864, but rejected by Yoshida (2001) and Agnarsson (2004) based on morphological evidence. *Spheropistha* species are tiny to small sized spiders (1.5-3.5 mm) that parasitize in the webs of other spiders (Ono, 2009; Foelix, 2011; Yin *et al.*, 2012; Lin *et al.*, 2022).

Spheropistha melanosoma Yaginuma, 1957 is the type species of the genus *Spheropistha*, originally described based on a female specimen from Japan and recorded in Korea and Japan so far (Yaginuma, 1957; Lee *et al.*, 2023). When we examined specimens collected from Guanshan National Nature Reserve of Jiangxi Province, China, we identified this species and found that it is closely similar to *Argyrodes incursus* Gray & Anderson, 1989 from Australia in copulatory organs and habitus. Although Tanikawa (1998) considered *Spheropistha* as a junior synonym of *Argyrodes*, he noted that *A. incursus* and *S. melanosoma* should be placed in the same genus. Therefore, we propose transferring *A. incursus* to the genus *Spheropistha* as a new combination.

Material and Methods

The specimens examined in this study were deposited in the National Animal Collection Resource Center in Beijing, China. Specimens were examined using Phenix XTL-165 stereo microscope. Photographs were taken using OLYMPUS BX51 microscope. The male palp was examined and photographed after dissection. The epigyne was treated in a warmed 0.1mg/ml Protease K solution. The terminology used in the text and figures follows Agnarsson (2004).

Fig. 1. Habitus of *Spheropistha melanosoma* Yaginuma, 1957. A-C. male. D-F. female. A, D. dorsal view. B, E. ventral view. C, F. lateral view. (Scale bars: 0.5 mm).

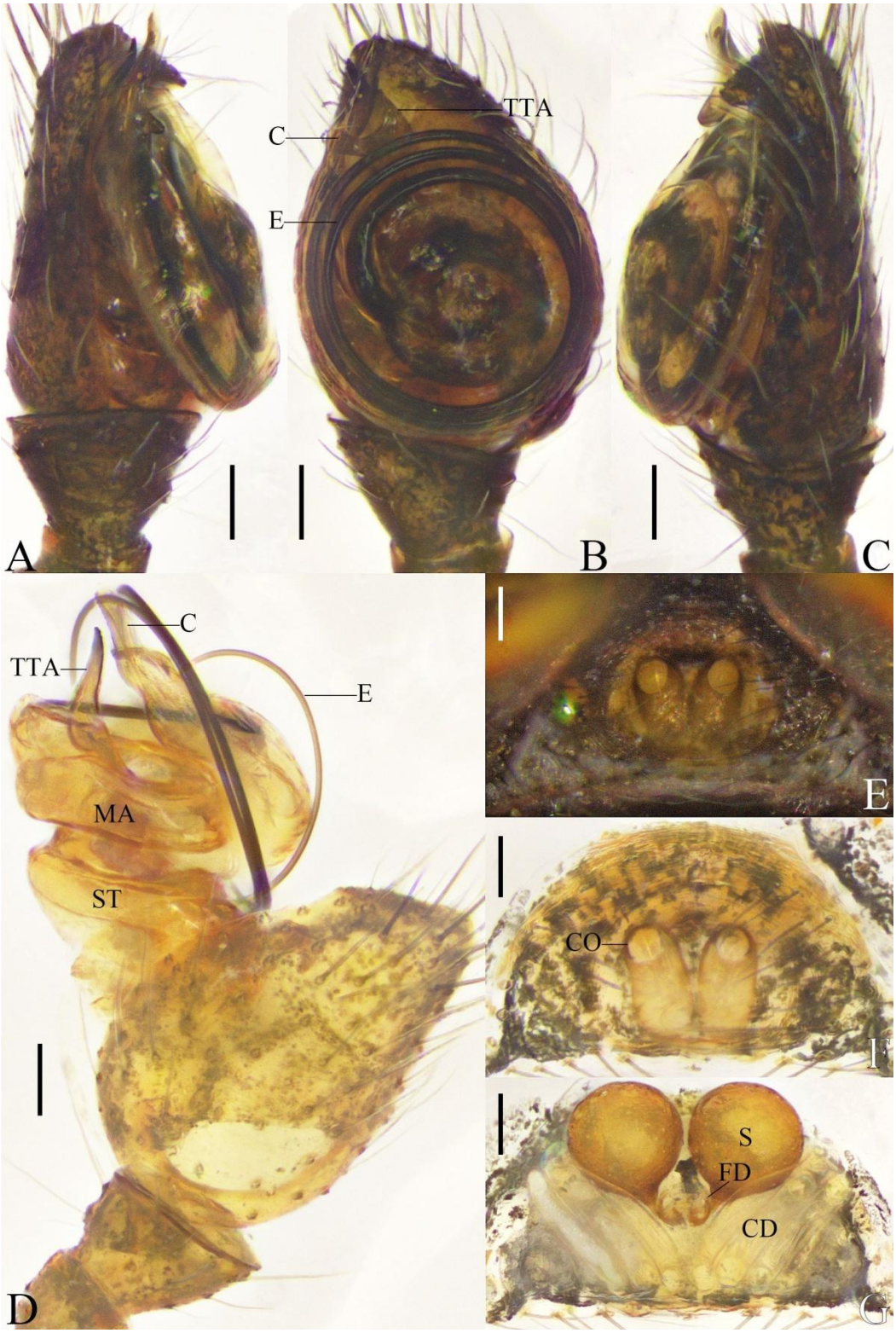

Fig. 2. Copulatory organs of *Spheropistha melanosoma* Yaginuma, 1957. A-D. Male left palp. A. prolateral view. B. ventral view. C. retrolateral view. D. left palp, expanded. E-F. Female epigyne. E. not dissected. F. ventral view. G. vulva, dorsal view. Abbreviations: C = conductor; CD = copulatory duct; CO = copulatory opening; E = embolus; FD = fertilization duct; MA = median apophysis; S = spermatheca; ST = subtegulum; TTA = theridiid tegular apophysis. (Scale bars: 0.05 mm).

Results

Family **Theridiidae** Sundevall, 1833
Subfamily **Argyrodinae** Simon, 1894
Genus ***Spheropistha*** Yaginuma, 1957

Diagnosis: Males with long, filiform and clockwise-coiled (left palp) embolus and nummular embolic base; females with long copulatory ducts and globose spermatheca (modified from Yoshida, 2001 and Yin *et al.*, 2012).
Type species: *Spheropistha melanosoma* Yaginuma, 1957.

Spheropistha melanosoma Yaginuma, 1957 (Figs. 1-4)

Spheropistha melanosoma Yaginuma, 1957: 15, fig. 2A-E; Yaginuma, 1960: 39, fig. 39.6-8; Yaginuma, 1971: 39, fig. 39.6-8; Brignoli, 1981: 16, figs. 11-12; Yaginuma, 1986: 53, fig. 28.8; Chikuni, 1989: 35, fig. 29; Yoshida, 2003: 141, figs. 381-383; Agnarsson, 2004: 480; Kim & Shin, 2009: 65, figs. 1-3; Yoshida, 2009: 384, figs. 270-272; Hidaka, 2022: 172, figs. 5-6; Lee *et al.*, 2023: 16, fig. 1A-H.
Argyrodes melanosoma Tanikawa, 1998: 22, figs. 3-5, 7, 8, 11, 13.

Type material (not examined)**:** Holotype ♀, Japan: Kochi Prefecture, Tosagun, Okawamura, 29 July 1953, K. Nakahira leg.

Material examined: 1♂, 10♀♀, China: Jiangxi Province: Yichun City, Guanshan National Nature Reserve, Tonggu County, Daixi Town, Longmen, 28.61056°N, 114.68972°E, elev. 725 m, 7 July 2024, C.H. Hu leg.

Diagnosis: See remarks under *S. nigroris* (Yoshida, Tso & Severinghaus, 2000) in Yoshida *et al.* (2000).

Biology: Spiders of this species parasitized on the web of *Parasteatoda tepidariorum* (C.L. Koch, 1841) (Theridiidae) on the rock face, where water droplets fall and humidity is high (Fig. 3). The egg sac was urn-shaped.

Distribution: China (Jiangxi Province, new record), Korea, Japan (Fig. 4).

Spheropistha incursus (Gray & Anderson, 1989) **comb. nov.**

Argyrodes incursus Gray & Anderson, 1989: 25, figs. 4-11.

Type material (not examined)**:** Holotype ♂, Australia: New South Wales: Newcastle, Blackbutt Reserve, March 1986, G. Anderson leg. (KS 18359). Paratypes: 4♀♀, with same data as holotype (KS 18360, KS 18361); 2♀♀, near Sydney, Royal National Park, Upper Causeway and Couranga Track, 4 March 1983, M. Gray & C. Horseman leg. (KS 12254–55).

Remarks: *Argyrodes incursus* was first described by Gray and Anderson (1989), based on specimens collected in New South Wales, Australia. The original illustrations and description of *A. incursus* bear all the diagnostic features and description of the genus *Spheropistha* (Yoshida, 2001; Yin *et al.*, 2012), including the long, filiform and clockwise-coiled embolus arising from nummular embolic base, the long conductor and the triangular theridiid tegular apophysis of the male palp, the long and coiled copulatory ducts, and the global spermathecae of the female vulva. Although the type specimens of *A.*

incursus were unavailable for examination, the comparison based on the illustrations provided by Gray & Anderson (1989) and characteristics provided by Yoshida (2001) enabled us to consider transferring *A. incursus* to the genus *Spheropistha* as a new combination.

Distribution: Australia.

Fig. 3. Photo of living female specimen of *Spheropistha melanosoma* Yaginuma, 1957 (red arrow) from Longmen, Guanshan National Nature Reserve, Jiangxi Province, China.

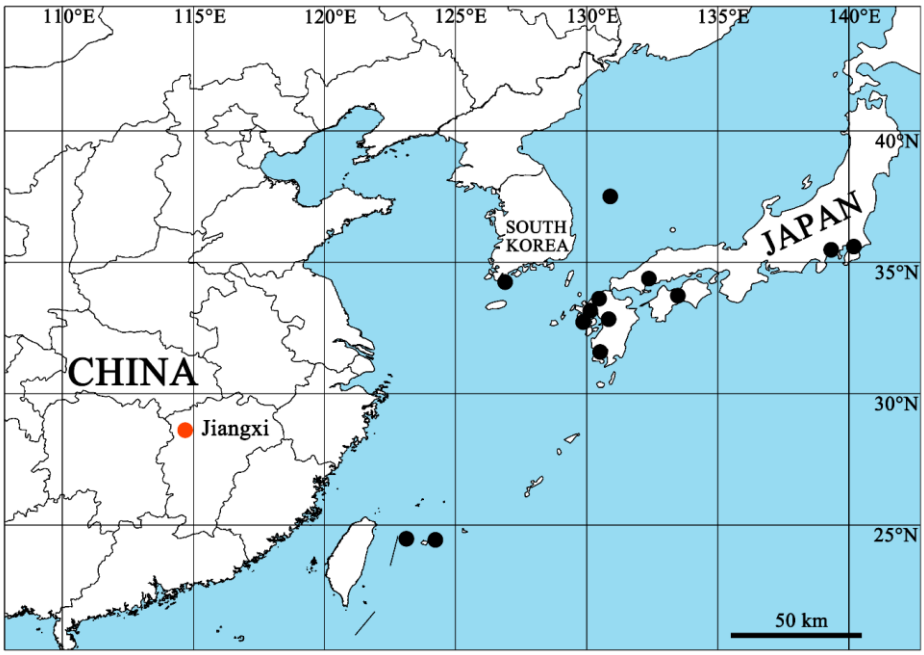

Fig. 4. Distribution map of *Spheropistha melanosoma* Yaginuma, 1957. Black circles represent known distribution and red circle represents new record.

Acknowledgment

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Checklist of aphidophagous spiders (Arachnida: Araneae) in India

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Abstract

Checklist of biodiversity of the aphidophagous spiders (Arachnida: Araneae) that play a vital role in natural control of insect population in all terrestrial ecosystems, in different states and the union territories of India is presented herewith along with their prey (aphid) species (Hemiptera: Aphididae) infesting different food plants. A total of 79 species of spiders were recorded as aphidophagous in 20 states/union territories of India belonging to 16 families, Araneidae being the largest one comprising 18 species under 9 genera followed by Thomisidae (12 species in 9 genera) and Salticidae (11 species in 10 genera). All these spiders prey on 53 species of aphids infesting 59 species of plants. Maximum 32 species of spiders accept *Aphis (Aphis) gossypii* Glover, 1877 as prey followed by *Aphis (Aphis) craccivora* Koch, 1854 (23 spider species of spiders) and *Lipaphis (Lipaphis) erysimi* (Kaltenbach, 1843) (12 spider species).

Keywords: Aphidophagous spiders, Araneae, aphids, checklist, India.

Introduction

The spiders (Araneae: Arachnida: Chelicerata: Arthropoda) are an exceedingly precious component of the earth's ecosystem being predatory consuming mostly insects keeping their population under check and hardly pose any danger to humans (Nyffeler & Birkhofer, 2017). They also serve as ecological indicators owing to their extreme sensitivity against their habitat disturbances (Stojanowska *et al.*, 2020). The order

Araneae ranks sixth, with 52,347 species in 4,396 genera belonging to 134 families (World Spider Catalog, 2024), after the five largest insect orders (Coleoptera, Lepidoptera, Hymenoptera, Diptera, Hemiptera) in terms of species diversity. Despite having very rich biodiversity and a tropical climate with biodiversity hotspots, only 2,245 species described under 563 genera comprising 65 families are recorded in India (Singh *et al.*, 2023a). As a major generalist predator group, spiders which feed on terrestrial arthropod communities, are one of the most abundant, diversified and omnipresent populations in both natural and agricultural habitats (Wise, 1993), though their potential as biocontrol agents is less exploited to its fullest, similar to ladybird beetles (Riechert & Lockley, 1984). The spider community comprise several different ecological guilds (a group of species utilising the same resource in similar ways) such as they are either of orb web weavers (trap the prey in silken circular or hexagonal web), stalkers or jumping spiders (active hunters), ground runners (chase the prey on the ground), foliage runners (on the foliage of the crops), space builders (irregular web to trap preys), ambushers (grasp unsuspecting insects that come within contact), etc. (Cardoso *et al.*, 2011). Thus, the spider community has several tactics to capture prey depending upon the species, habitats and kind of food. It implies that by having several different guilds, they are generally more likely to suppress insect pests than more homogenous communities like insect predators and parasitoids (Uetz, 1992). Also, they are relatively resistant to starvation, pesticides and desiccation in agricultural ecosystems and the risks associated with using them to control pests are minimal (Riechert & Lockley, 1984). However, the significance of the spiders in natural control agents in agroecosystems, forest ecosystems, and other terrestrial ecosystems is largely unknown (Nyffeler & Benz, 1987).

Spiders are common generalist predators in agroecosystems and have been suggested to lower herbivore abundance in crops. However, it is not clear, if spiders can effectively suppress pest populations (Gavish-Regev *et al.*, 2009). Generalist predators usually live longer than their prey and prey on many types of prey. Because of this lack of specificity, generalist predators do not usually exhibit a density-dependent response to their prey and according to Hassell (1978) the generalist predators do not efficiently control populations of their prey. Moreover, as natural bioagents, the role of spiders in rice fields (Barrion & Litsinger, 1995; Singh & Singh, 2014; Joshi & Venkateshwarlu, 2016), cotton fields (Jeyaparvathi *et al.*, 2013; Nagrare *et al.*, 2015; Deshmukh, 2017), wheat fields (Birkhofer *et al.*, 2008; Sherawat & Butt, 2014) and apple orchards (Wyss *et al.*, 1995; Khan, 2016) had already been acknowledged.

The aphids (Hemiptera: Aphididae) are soft–bodied plant sap–sucking insects infesting almost all parts of several species of plants. Globally, more than 250 species of aphids are notorious pests of both agricultural and horticultural crops (Singh & Singh, 2016). Sometimes, the damage in some crops is to the extent that nothing remains to harvest, particularly in the case of some cereals, potatoes and mustard (Singh & Singh, 2021a). There is a number of unique features that contribute to their success such as polyphagy, peculiar mode of reproduction, development, and polymorphism. According to the climatic conditions and availability of the food plants, they may reproduce either by parthenogenesis, zygogenesis, or pedogenesis. They may either be oviparous or viviparous or both (Singh & Singh, 2022).

In India, very few studies have been conducted to evaluate the biotic potential of spiders against aphid pests, for example, on *Aphis (Aphis) craccivora* Koch, 1854 on cotton (Sebastian & Sudhikumar, 2002), *Aphis (Aphis) gossypii* Glover, 1877 on cotton (Jeyaparvathi *et al.*, 2013), *Aphis (Aphis) pomi* de Geer, 1773 on apple (Khan, 2016), *Lipaphis (Lipaphis) erysimi* (Kaltenbach, 1843) on mustard (Shaikh *et al.*, 2020), and *Myzus (Nectarosiphon) persicae* (Sulzer, 1776) on brassica crops (Anusha *et al.*, 2022).

Most of the studies are concerned with the empirical records of spiders as aphid predators in a particular area. The spiders occupy all the terrestrial ecosystems (Singh *et al.*, 2023a). They are globally distributed and, in general, mostly are entomophagous. However, excessive anthropogenic activities and pollution badly affect their disrtribution (Prakash & Verma, 2022; Singh *et al.*, 2023b). Information on spider predation on aphids is very limited and need intensive studies. In the present article, the available data of spiders and their aphid preys along with the host plants in different states/union territories of India are compiled.

Material and Methods

The present checklist is based on the published literature on aphidophagous spiders, e.g. books, book chapters, journals, proceedings of conferences, and a few authentic theses up to June 25, 2024. In most of the recent past literature, there are several errors in the scientific names of the spiders as well as aphids and food plants because of their modified status and other nomenclatural decisions and clarification. The names of aphids, as well as plants that were misspelt in the original records have been corrected where we logically ascertain the intended species. In the present checklist, attempts have been made to provide the valid scientific names of the predators following World Spider Catalog (2024), aphids following Favret (2024), and of the plants, following (World Flora Online, 2024). For synonymy of valid species, above references should be consulted. If a spider species is identified only up to a generic level, it was considered as species only if no other species of that genus is reported within that state.

Table 1. Number of families of aphidophagous spiders, prey (aphid) species, host plant species, number of triplets (predator-prey-host plant) and their distribution in India.

Spider families	Number of spider species	Number of prey (aphid) species	Number of host plant species	Number of triplets	Number of states/union territories
1. Agelenidae	1	1	1	1	1
2. Araneidae	18	27	34	72	11
3. Cheiracanthiidae	2	10	10	10	3
4. Clubionidae	2	11	10	15	7
5. Corinidae	1	1	1	2	1
6. Dictynidae	1	2	1	1	1
7. Eresidae	1	1	1	1	1
8. Linyphiidae	1	2	2	2	2
9. Lycosidae	7	5	8	18	5
10. Oxyopidae	9	8	14	30	13
11. Philodromidae	2	3	4	4	3
12. Salticidae	11	22	23	39	10
13. Tetragnathidae	4	7	9	12	6
14. Theridiidae	4	18	20	22	6
15. Thomisidae	12	18	18	32	6
16. Uloboridae	1	2	3	3	2
17. Unidentified families	3	3	5	5	5
Total	80	53	59	269	20

Results and Discussion

Table (1) demonstrates that a total of 79 species of spiders are aphidophagous in India belonging to 16 families, Araneidae being the largest one comprising 18 species

under 9 genera followed by Thomisidae (12 species in 9 genera) and Salticidae (11 species in 10 genera), and others having less than 10 species; preying on 53 species of aphids associated with 59 species of plants in 20 states/union territories.

About 41% of the spiders (32 species) preferred *Aphis (Aphis) gossypii* Glover as prey on only 10 host plant species with 59 triplets (spider-aphid-host plant) in 12 states/union territories of India. Next preferred preys are *Aphis (Aphis) craccivora* Koch (23 spider species on 6 host plants with 26 triplets in 7 states/union territories) and *Lipaphis (Lipaphis) erysimi* (Kaltenbach) (12 spider species on 4 host plants with 22 triplets in only 3 states). In India, a total of 269 tritrophic relationships (triplets of predator-prey-food plant) were recorded.

Table 2. Number of aphidophagous spider species, prey (aphid) species, host plant species, triplets (predator-prey-host plant) in different states/union territories of India.

Name of the states	Number of spider species	Number of prey (aphid) species	Number of host plant species	Number of triplets
1. Andhra Pradesh	2	2	2	4
2. Assam	1	1	1	1
3. Chhattisgarh	4	1	2	5
4. Gujarat	15	2	2	16
5. Haryana	1	1	1	1
6. Himachal Pradesh	13	21	13	26
7. Jammu & Kashmir	7	1	1	7
8. Karnataka	1	1	1	1
9. Kerala	3	2	2	6
10. Madhya Pradesh	3	1	1	3
11. Maharashtra	18	7	11	49
12. Manipur	1	1	1	1
13. Odisha	3	1	1	3
14. Rajasthan	1	2	2	2
15. Sikkim	2	3	2	4
16. Tamil Nadu	18	2	4	31
17. Telangana	3	1	1	6
18. Uttar Pradesh	5	2	2	3
19. Uttarakhand	17	27	24	70
20. West Bengal	16	8	13	35
Total	79	53	59	267

In India, the aphidophagous spiders are distributed only in 20 states/union territories. A maximum of 18 species were recorded each from Maharashtra and Tamil Nadu followed by 17 species from Uttarakhand, 15 species each from Gujarat and West Bengal, 13 species from Himachal Pradesh, and less than 10 species were recorded from other states/union territories (Table 2). No species of aphidophagous spiders is recorded from 10 states and 7 union territories of India. Indeed, no survey was conducted in these regions and hence, it requires an extensive survey in these regions of India. Most of the surveys were conducted in Gujarat, Himachal Pradesh, Maharashtra, Tamil Nadu, Uttarakhand and West Bengal.

Following is the detailed list of these spiders along with their aphid preys and food plants recorded from different states/union territories of India:

A. Family Agelenidae: The members of this family are commonly known as funnel web spiders or funnel weaver or sheet-web spiders. Most of them are nocturnal and are good ambusher and waits in a concealed position to launch a surprise attack on preys or any

invaders (Singh *et al.*, 2021a). Record of an unidentified *Agelena* sp. feeding on unidentified aphid on unidentified food plant recorded in Maharashtra (Patil *et al.*, 2018) seems to be doubtful (?).

B. Family Araneidae: These spiders are globally distributed and commonly known as the orb-weaver spiders as they build spiral wheel-shaped webs in the houses, gardens, tree branches, tall grasses, agricultural fields, and bushes. They are typically nocturnal and most active during evening hours and hide themselves in the middle of the webs hanging upside down during the daytime (Singh & Singh, 2021b). In agricultural fields, few species of these spiders are found in their webs. In India, 18 species of spiders of this family are recorded preying on 27 species of aphids feeding on 34 food plants in 11 states as mentioned below.

1. *Araneus* sp.

Aphis (Aphis) gossypii Glover, 1877

Benincasa hispida Cogn. – Chhattisgarh (Bisen *et al.*, 2017)

Capsicum frutescens L. – Sikkim (Raychaudhuri *et al.*, 1978)

Aphis (Aphis) pomi de Geer, 1773

Malus domestica (Suckow) Borkh. (syn. *Pyrus malus* L.) – Jammu & Kashmir (Bhagat *et al.*, 1988)

Aphis (Toxoptera) citricidus (Kirkaldy, 1907)

Citrus sp. – Maharashtra (Kale *et al.*, 2020)

Capitophorus formosartemisiae (Takahashi, 1921)

Artemisia sp. – Himachal Pradesh (Das & Raychaudhuri, 1983)

Cinara (Cinara) comata Doncaster, 1956

Pinus sp. – Himachal Pradesh (Agarwala *et al.*, 1981)

Macrosiphum (Macrosiphum) rosae (Linnaeus, 1758)

Rosa sp. – Sikkim (Raychaudhuri *et al.*, 1978); West Bengal (Debnath, 2020)

Sitobion (Sitobion) rosaeiformis (Das, 1918)

Rosa sp. – Sikkim (Raychaudhuri *et al.*, 1978); West Bengal (Debnath, 2020)

2. *Araniella nympha* (Simon, 1889)

Acyrthosiphon (Acyrthosiphon) rubi Narzikulov, 1957

Rubus ellipticus Sm. – Uttarakhand (Debnath, 1991)

Sitobion (Sitobion) miscanthi (Takahashi, 1921)

Triticum aestivum L. – Uttarakhand (Debnath, 1991)

Tumoranuraphis indica (Chakrabarti & Maity, 1984)

Prunus cornuta (Wall. ex Royle) Steud. – Uttarakhand (Debnath, 1991)

3. *Argiope anasuja* Thorell, 1887

Unidentified aphid – Maharashtra (Patil *et al.*, 2018)

4. *Argiope catenulata* (Doleschall, 1859)

Aphis (Aphis) gossypii Glover, 1877

Gossypium hirsutum L. – Tamil Nadu (Mathirajan & Reghupathy, 2003)

5. *Argiope luzona* (Walckenaer, 1841)

Aphis (Aphis) gossypii Glover, 1877

Solanum melongena L. – Tamil Nadu (Sankari & Thiyagesan, 2010)

Trichosanthes cucumerina L. – Tamil Nadu (Sankari & Thiyagesan, 2010)

6. *Argiope minuta* Karsch, 1879

Aphis (Aphis) gossypii Glover, 1877

5 *Gossypium hirsutum* L. – Tamil Nadu (Kannan *et al.*, 2004)

7. *Argiope pulchella* Thorell, 1881

Aphis (Aphis) gossypii Glover, 1877

Gossypium hirsutum L. – Tamil Nadu (Vanitha *et al.*, 2009)

8. *Bijoaraneus mitificus* (Simon, 1886)

Unidentified plant – Maharashtra (Patil *et al.*, 2018)

9. *Cyclosa insulana* (Costa, 1834)

Aphis (Aphis) craccivora Koch, 1854

Vicia faba L. – West Bengal (Raychaudhuri *et al.*, 1979; Debnath, 2020)

10. *Cyclosa* sp.

Sitobion (Sitobion) rosaeiformis (Das, 1918)

Rosa sp. – Sikkim (Raychaudhuri *et al.*, 1978); West Bengal (Raychaudhuri *et al.*, 1978)

11. *Cyrtophora cicatrosa* (Stoliczka, 1869)

Aphis (Aphis) gossypii Glover, 1877

Solanum melongena L. – Tamil Nadu (Sankari & Thiyagesan, 2010)

Trichosanthes cucumerina L. – Tamil Nadu (Sankari & Thiyagesan, 2010)

Aphis (Toxoptera) citricidus (Kirkaldy, 1907)

Citrus sp. – Maharashtra (Kale *et al.*, 2020)

Rhopalosiphum padi (Linnaeus, 1758)

Triticum aestivum L. – Uttar Pradesh (Mishra & Rastogi, 2020)

12. *Eriovixia* sp.

Aphis (Aphis) gossypii Glover, 1877

Abelmoschus esculentus Moench – Maharashtra (Kale *et al.*, 2020)

Gossypium hirsutum L. – Maharashtra (Kale *et al.*, 2020)

Helianthus annuus L. – Maharashtra (Kale *et al.*, 2020)

Aphis (Toxoptera) citricidus (Kirkaldy, 1907)

Citrus sp. – Maharashtra (Kale *et al.*, 2020)

Hysteroneura setariae (Thomas, 1878)

Triticum aestivum L. – Maharashtra (Kale *et al.*, 2020)

Lipaphis (Lipaphis) erysimi (Kaltenbach, 1843)

Brassica rapa L. – Maharashtra (Kale *et al.*, 2020)

Rhopalosiphum maidis (Fitch, 1856)

Sorghum bicolor (L.) Moench – Maharashtra (Kale *et al.*, 2020)

Uroleucon (Uromelan) compositae (Theobald, 1915)

Carthamus tinctorius L. – Maharashtra (Raychaudhuri *et al.*, 1979; Kale *et al.*, 2020)

13. *Neoscona elliptica* Tikader & Bal, 1981

Myzus (Myzus) dycei Carver, 1961

Urtica dioica L. – Uttarakhand (Debnath, 1991)

14. *Neoscona mukerjei* Tikader, 1980

Aphis (Aphis) craccivora Koch, 1854

Vigna unguiculata (L.) Walp. – Kerala (Manu, 2005)

Aphis (Aphis) gossypii Glover, 1877

Abelmoschus esculentus Moench – Kerala (Manu, 2005)

Aphis (Aphis) kurosawai Takahashi, 1921

Artemisia vulgaris L. – Uttarakhand (Debnath, 1991)

Aphis (Aphis) pomi de Geer, 1773

Malus domestica (Suckow) Borkh. – Jammu & Kashmir (Khan, 2009)

Sitobion (Sitobion) miscanthi (Takahashi, 1921)

Triticum aestivum L. – Uttarakhand (Debnath, 1991)

15. *Neoscona nautica* (L. Koch, 1875)

Macrosiphum (Macrosiphum) rosae (Linnaeus, 1758)

Rosa sp. – West Bengal (Raychaudhuri *et al.*, 1979; Kale *et al.*, 2020)

Sitobion (Sitobion) rosaeiformis (Das, 1918)

Rosa sp. – West Bengal (Debnath, 2020)

16. *Neoscona shillongensis* Tikader & Bal, 1981

Aphis (Aphis) pomi de Geer, 1773

Malus domestica (Suckow) Borkh. – Jammu & Kashmir (Khan, 2016)

17. *Neoscona theisi* (Walckenaer, 1841)

Aphis (Aphis) gossypii Glover, 1877

Abelmoschus esculentus Moench – Chhattisgarh (Chaturvedani *et al.*, 2023)

Benincasa hispida Cogn. – Chhattisgarh (Bisen *et al.*, 2017)

Gossypium hirsutum L. – Maharashtra (Nagrare *et al.*, 2015); Tamil Nadu (Kannan *et al.*, 2004; Mathirajan & Reghupathy, 2003); Telangana – (Mallesh & Sravanthy, 2021)

Rhopalosiphum padi (Linnaeus, 1758)

Triticum aestivum L. – Uttar Pradesh (Mishra & Rastogi, 2020)

18. *Neoscona vigilans* (Blackwall, 1865) [syn. *Neoscona rumpfi* Thorell, 1878]

Myzus (Myzus) dycei Carver, 1961

Urtica parviflora Roxb. – Himachal Pradesh (Das & Raychaudhuri, 1983)

19. *Neoscona* sp.

Aphis (Aphis) craccivora Koch, 1854

Arachis hypogaea L – Tamil Nadu (Abarna, 2020)

Lablab purpureus (L.) Sweet ssp. *purpureus* – Maharashtra (Kale *et al.*, 2020)

Aphis (Aphis) gossypii Glover, 1877

Abelmoschus esculentus Moench – Maharashtra (Kale *et al.*, 2020)

Gossypium hirsutum L. – Andhra Pradesh (Dhillon & Sharma, 2013); Maharashtra (Kale *et al.*, 2020)

Helianthus annuus L. – Maharashtra (Kale *et al.*, 2020)

Aphis (Toxoptera) citricidus (Kirkaldy, 1907)

Citrus sp. – Maharashtra (Kale *et al.*, 2020)

Brachycaudus (Brachycaudus) helichrysi (Kaltenbach, 1843)

Prunus persica (L.) Batsch – Uttarakhand (Debnath, 1991)

Capitophorus formosartemisiae (Takahashi, 1921)

Artemisia vulgaris L. – Uttarakhand (Debnath, 1991)

Chaitophorus kapuri Hille Ris Lambers, 1966

Populus sp. – Himachal Pradesh (Das & Raychaudhuri, 1983)

Hysteroneura setariae (Thomas, 1878)

Triticum aestivum L. – Maharashtra (Kale *et al.*, 2020)

Liosomaphis himalayensis Basu, 1964

Berberis aristata DC. – Uttarakhand (Debnath, 1991)

Berberis sp. – Himachal Pradesh (Das & Raychaudhuri, 1983)

Lipaphis (Lipaphis) erysimi (Kaltenbach, 1843)

Brassica rapa L. – Uttarakhand (Debnath, 1991); Maharashtra (Kale *et al.*, 2020)

Megoura dooarsis (Ghosh & Raychaudhuri, 1969)

Indet Fabaceae – Himachal Pradesh (Das & Raychaudhuri, 1983)

Metopolophium sp.

Spiraea canescens D. Don – Himachal Pradesh (Das & Raychaudhuri, 1983)

Myzus (Myzus) dycei Carver, 1961

Urtica dioica L. – Uttarakhand (Debnath, 1991)

Myzus (Nectarosiphon) persicae (Sulzer, 1776)
Solanum tuberosum L. – West Bengal (Nayak *et al.*, 2019)
Prociphilus sp.
Lonicera quinquelocularis Hardw. – Uttarakhand (Debnath, 1991)
Rhopalosiphum maidis (Fitch, 1856)
Sorghum bicolor (L.) Moench – Maharashtra (Kale *et al.*, 2020)
Sappaphis sp.
Cotoneaster bacillaris Wall. ex Lindl. – Uttarakhand (Debnath, 1991)
Schoutedenia emblica (Patel & Kulkarni, 1952)
Phyllanthus emblica L. – Uttar Pradesh (Singh *et al.*, 2018)
Sitobion (Sitobion) miscanthi (Takahashi, 1921)
Triticum aestivum L. – Uttarakhand (Debnath, 1991)
Uroleucon (Uromelan) compositae (Theobald, 1915)
Carthamus tinctorius L. – Maharashtra (Kale *et al.*, 2020)

C. Family Cheiracanthiidae: The members of this family are commonly known as yellow sac spiders which typically build flat silk sacs at the place where they rest most of the daytime. They are active foragers and they search for prey rather than capture it within a web as they never spin web (Singh *et al.*, 2020). In India, 34 species of spiders of this family are recorded in 25 states and 5 union territories (Singh *et al.*, 2023a), but only 2 identified and few unidentified species of the genus *Cheiracanthium* were observed as aphidophagous on 10 aphid species feeding on 10 food plants 3 states/union territories as mentioned below.

1. *Cheiracanthium himalayense* Gravely, 1931
Aphis (Aphis) pomi de Geer, 1773
Malus domestica (Suckow) Borkh. – Jammu & Kashmir (Khan, 2009)

2. *Cheiracanthium melanostomum* (Thorell, 1895)
Aphis (Aphis) craccivora Koch, 1854
Gossypium hirsutum L. – Gujarat (Sebastian & Sudhikumar, 2002)

3. *Cheiracanthium* sp.
Aphis (Aphis) clematidis Koch, 1854
Clematis buchananiana Wall. – Uttarakhand (Debnath, 1991)
Eriosoma lanigerum (Hausmann, 1802)
Malus domestica (Suckow) Borkh. – Uttarakhand (Debnath, 1991)
Liosomaphis himalayensis Basu, 1964
Berberis aristata DC. – Uttarakhand (Debnath, 1991)
Melanaphis nr. *arundinariae* (Takahashi, 1937)
Pyrus pashia Buch.–Ham. ex D. Don – Uttarakhand (Debnath, 1991)
Pemphigus (Pemphigus) mordwilkoi Cholodkovsky, 1912
Populus ciliata Wall. ex Royle – Uttarakhand (Debnath, 1991)
Prociphilus sp.
Lonicera quinquelocularis Hardw. – Uttarakhand (Debnath, 1991)
Sappaphis sp.
Cotoneaster bacillaris Wall. ex Lindl. – Uttarakhand (Debnath, 1991)
Sitobion (Sitobion) miscanthi (Takahashi, 1921)
Triticum aestivum L. – Uttarakhand (Debnath, 1991)

D. Family Clubionidae: The family Clubionidae, commonly known as sac spiders, do not spin web and construct flattened tubular dense white retreats that often had two openings, usually made on rolled leaves. Mostly they are nocturnal hunters and capture

the prey by suddenly jumping upon it and grabbing it with their stout toothed chelicerae. These sac spiders are one of the common predators of insect pests in the crop fields and gardens (Singh BB *et al.*, 2020). In India, 34 species of the spiders of this family are recorded in 22 states and 4 union territories (Singh *et al.*, 2023a), however, only two identified and few unidentified species of the genus *Clubiona* were observed as aphidophagous on 11 aphid species feeding on 10 food plants in 7 states.

1. *Clubiona drassodes* O. Pickard-Cambridge, 1874

Aphis (Aphis) gossypii Glover, 1877

Gossypium hirsutum L. – Tamil Nadu (Vanitha *et al.*, 2009)

2. *Clubiona filicata* O. Pickard-Cambridge, 1874 (syn. *Clubiona pashabhaii* Patel & Patel, 1973)

Aphis (Aphis) craccivora Koch, 1854

Gossypium hirsutum L. – Gujarat (Sebastian & Sudhikumar, 2002)

3. *Clubiona* sp.

Aphis (Aphis) gossypii Glover, 1877

Gossypium hirsutum L. – Andhra Pradesh (Dhillon & Sharma, 2013); – Maharashtra (Kale *et al.*, 2020)

Helianthus annuus L. – Maharashtra (Kale *et al.*, 2020)

Unidentified plant – Himachal Pradesh (Das & Raychaudhuri, 1983)

Aspidophorodon (Eoessigia) indicum (David, Rajasingh & Narayanan, 1972)

Cotoneaster bacillaris Wall. ex Lindl. – Uttarakhand (Debnath, 1991)

Brachycaudus (Brachycaudus) helichrysi (Kaltenbach, 1843)

Erigeron bonariensis L. – Uttarakhand (Debnath, 1991)

Prunus persica (L.) Batsch – Uttarakhand (Debnath, 1991)

Brevicoryne brassicae (Linnaeus, 1758)

Brassica oleracea L. var *botrytis* – Uttar Pradesh (Singh *et al.*, 2016)

Macrosiphoniella (Macrosiphoniella) sanborni (Gillette, 1908)

Chrysanthemum sp. – Himachal Pradesh (Das & Raychaudhuri, 1983)

Myzus (Myzus) ornatus (Laing, 1932)

Unidentified plant – Himachal Pradesh (Agarwala *et al.*, 1981)

Prociphilus sp.

Lonicera quinquelocularis Hardw. – Uttarakhand (Debnath, 1991)

Sappaphis sp.

Cotoneaster bacillaris Wall. ex Lindl. – Uttarakhand (Debnath, 1991)

Schoutedenia emblica (Patel & Kulkarni, 1952)

Phyllanthus emblica L. – Uttar Pradesh (Singh *et al.*, 2018)

Tumoranuraphis indica (Chakrabarti & Maity, 1984)

Prunus cornuta (Wall. ex Royle) Steud. – Uttarakhand (Debnath, 1991)

E. Family Corinnidae: The members of the family Corinnidae are commonly called as corinnid sac spiders. They are hunters and build silken retreats, or sacs, usually on plant terminals, between leaves, under bark or under rocks. The family is distributed in 16 Indian states and 3 union territories (Singh *et al.*, 2021a). Only one species, *Castianeira* sp. feeding on *Aphis (Aphis) gossypii* Glover, 1877 infesting *Gossypium hirsutum* L. is recorded in Gujarat (Dhulia & Yadav, 1991).

F. Family Dictynidae: Dictynids are commonly known as mesh-weavers usually spin irregular and complex web on the tops of small bushes or the dry standing remains of weeds, making a tangle of silken fibers, sometimes with zigzag lines (Sharma *et al.*, 2021). In India, only 15 species are reported from 13 states and 3 union territories (Singh

et al., 2023a), but only an unidentified species of the type genus *Dictyna* is recorded as aphidophagous on 2 aphid species in Himachal Pradesh as given below.

1. *Dictyna* sp.

Chaetosiphon (Pentatrichopus) tetrarhodum (Walker, 1849)

Rosa sp. – Himachal Pradesh (Das & Raychaudhuri, 1983)

Sitobion (Sitobion) rosaeiformis (Das, 1918)

Rosa sp. – Himachal Pradesh (Agarwala *et al.*, 1981)

G. Family Eresidae: The family Eresidae, commonly known as velvet spiders, is a small group of spiders and typically build very large silken nests in vegetation in which hundreds of individuals live together (Tikader & Biswas, 1981). In India, only 5 species of a single genus *Stegodyphus* are reported from 17 states and 3 union territories (Sharma *et al.*, 2021), however, only one species, *Stegodyphus sarasinorum* Karsch, 1892 is recorded as aphidophagous on *Rhopalosiphum padi* (Linnaeus, 1758) infesting *Triticum aestivum* L. in Uttar Pradesh (Mishra & Rastogi, 2020).

H. Family Linyphiidae: The spiders of this family are commonly known as sheet weavers, or money spiders and are distributed in the temperate regions. They construct a sheet web sometimes dome shaped at ground level but they may inhabit a very wide array of habitats. Their webs do not have retreat and the spider always hang inverted below the sheet (Sharma *et al.*, 2020). In India, 83 species are recorded (Singh *et al.*, 2023a), out of which, only an unidentified species of the type genus *Linyphia* is recorded as aphidophagous as given below.

1. *Linyphia* sp.

Hyalopterus pruni (Geoffroy, 1762)

Phragmites karka (Retz.) Trin. ex Steud. – Manipur (Raychaudhuri *et al.*, 1978)

Taoia indica (Ghosh & Raychaudhuri, 1972)

Alnus nepalensis D. Don – West Bengal (Raychaudhuri *et al.*, 1979; Debnath, 2020)

I. Family Lycosidae: The members of this family are commonly called as wolf spiders. Mostly, they are diurnal and do not spin webs for capturing prey, but they run about in grass, leaf litter, over sandy or stony areas, across the surface of the water and many other places and hunt the prey actively (Singh, 2021a). In India, 147 species are known (Singh *et al.*, 2023a) which are distributed widely. However, only 7 species are aphidophagous preying on 5 species of aphids infesting 8 food plants in 5 states/union territories as mentioned below.

1. *Hippasa pantherina* Pocock, 1899

Aphis (Aphis) gossypii Glover, 1877

Solanum melongena L. – Tamil Nadu (Sankari & Thiyagesan, 2010)

Trichosanthes cucumerina L. – Tamil Nadu (Sankari & Thiyagesan, 2010)

2. *Lycosa poonaensis* Tikader & Malhotra, 1980

Aphis (Aphis) craccivora Koch, 1854

Gossypium hirsutum L. – Gujarat (Sebastian & Sudhikumar, 2002)

3. *Lycosa tista* Tikader, 1970

Aphis (Aphis) craccivora Koch, 1854

Gossypium hirsutum L. – Gujarat (Sebastian & Sudhikumar, 2002)

4. *Pardosa altitudis* Tikader & Malhotra, 1980

Aphis (Aphis) pomi de Geer, 1773

Malus domestica (Suckow) Borkh. – Jammu & Kashmir (Khan, 2016)

5. *Pardosa pseudoannulata* (Bösenberg & Strand, 1906) [syn. *Lycosa pseudoannulata* Fox, 1935]

Aphis (Aphis) gossypii Glover, 1877

Gossypium hirsutum L. – Tamil Nadu (Kannan *et al.*, 2004)

Solanum melongena L. – Tamil Nadu (Sankari & Thiyagesan, 2010); West Bengal (Satpathi, 1999)

Trichosanthes cucumerina L. – Tamil Nadu (Sankari & Thiyagesan, 2010)

Lipaphis (Lipaphis) erysimi (Kaltenbach, 1843)

Brassica oleracea L. – Maharashtra (Shaikh *et al.*, 2020)

Brassica rapa L. – Maharashtra (Shaikh *et al.*, 2020)

Raphanus sativus L. – Maharashtra (Shaikh *et al.*, 2020)

6. *Pardosa sumatrana* (Thorell, 1890)

Aphis (Aphis) craccivora Koch, 1854

Gossypium hirsutum L. – Gujarat (Sebastian & Sudhikumar, 2002)

7. *Pardosa* sp.

Aphis (Aphis) gossypii Glover, 1877

Solanum melongena L. – West Bengal (Satpathi, 1999)

8. *Wadicosa fidelis* (O. Pickard-Cambridge, 1872)

Aphis (Aphis) craccivora Koch, 1854

Gossypium hirsutum L. – Gujarat (Sebastian & Sudhikumar, 2002)

Lipaphis (Lipaphis) erysimi (Kaltenbach, 1843)

Brassica oleracea L. – Maharashtra (Shaikh *et al.*, 2020)

Brassica rapa L. – Maharashtra (Shaikh *et al.*, 2020)

Raphanus sativus L. – Maharashtra (Shaikh *et al.*, 2020)

9. Unidentified species

Myzus (Nectarosiphon) persicae (Sulzer, 1776)

Brassica oleracea L. *capitata* – West Bengal (Anusha *et al.*, 2022)

J. Family Oxyopidae: The Oxyopidae, commonly called as lynx spiders, are tropical in distribution. Most of the *Oxyopes* species have cryptic colour to blend in with the vegetation and actively search for prey, stalk and often leap from branch to leaf and finally jumping on its prey like cats or leaping a few centimetres into the air to catch flying insects. The lynx spiders are abundant enough to be important in agricultural systems as biological control agents; it is particularly common in cotton, soybean, grain sorghum, and alfalfa and feeds on a wide range of pest species (Singh, 2021b). At present, 98 species are recorded from India (Singh *et al.*, 2023a), out of which, only 9 species are known to prey on 8 species of aphids infesting 14 species of host plants in 13 states as mentioned below.

1. *Oxyopes birmanicus* Thorell, 1887

Aphis (Aphis) craccivora Koch, 1854

Vigna unguiculata (L.) Walp. – Madhya Pradesh (Upadhyay *et al.*, 2020)

Aphis (Aphis) gossypii Glover, 1877

Gossypium hirsutum L. – Tamil Nadu (Jeyaparvathi *et al.*, 2013)

2. *Oxyopes chittrae* Tikader, 1965

Aphis (Aphis) craccivora Koch, 1854

Gossypium hirsutum L. – Gujarat (Sebastian & Sudhikumar, 2002)

3. *Oxyopes hindostanicus* Pocock, 1901 [syn. *Oxyopes pankaji* Gajbe & Gajbe, 2000]

Aphis (Aphis) gossypii Glover, 1877

Gossypium hirsutum L. – Maharashtra (Nagrare *et al.*, 2015; Kale *et al.*, 2020)

Rhopalosiphum maidis (Fitch, 1856)
Sorghum bicolor (L.) Moench – Maharashtra (Kale *et al.*, 2020)

4. *Oxyopes javanus* Thorell, 1887
Aphis (Aphis) craccivora Koch, 1854
Vigna unguiculata (L.) Walp. – Kerala (Manu, 2005)
Aphis (Aphis) gossypii Glover, 1877
Abelmoschus esculentus Moench – Kerala (Manu, 2005)
Gossypium hirsutum L. – Tamil Nadu (Kannan *et al.*, 2004; Mathirajan & Reghupathy, 2003
Solanum melongena L. – Tamil Nadu (Vanitha *et al.*, 2009; Sankari & Thiyagesan, 2010)
Trichosanthes cucumerina L. – Tamil Nadu (Sankari & Thiyagesan, 2010)
Lipaphis (Lipaphis) erysimi (Kaltenbach, 1843)
Brassica juncea (L.) Czern. – West Bengal (Ghosh, 1983)
Brassica sp. – West Bengal (Agarwala *et al.*, 1981)

5. *Oxyopes lineatipes* (C.L. Koch, 1847)
Aphis (Aphis) gossypii Glover, 1877
Solanum melongena L. – Tamil Nadu (Sankari & Thiyagesan, 2010)
Trichosanthes cucumerina L. – Tamil Nadu (Sankari & Thiyagesan, 2010)

6. *Oxyopes salticus* Hentz, 1845
Aphis (Aphis) gossypii Glover, 1877
Gossypium hirsutum L. – Tamil Nadu (Jeyaparvathi *et al.*, 2013)
Aphis (Aphis) craccivora Koch, 1854
Gossypium hirsutum L. – Gujarat (Sebastian & Sudhikumar, 2002)

7. *Oxyopes shweta* Tikader, 1970
Aphis (Aphis) craccivora Koch, 1854
Gossypium hirsutum L. – Gujarat (Sebastian & Sudhikumar, 2002)

8. *Oxyopes* sp.
Aphis (Aphis) craccivora Koch, 1854
Arachis hypogaea L. – Tamil Nadu (Abarna, 2020)
Aphis (Aphis) gossypii Glover, 1877
Benincasa hispida Cogn. – Chhattisgarh (Bisen *et al.*, 2017)
Solanum melongena L. – Assam (Borkakati *et al.*, 2019); Odisha (Singh *et al*., 2023)
Aphis (*Toxoptera*) *aurantii* Boyer de Fonsc., 1841
Camellia sinensis (L.) Kuntze – Himachal Pradesh (Sharma & Kashyap, 2002)
Brevicoryne brassicae (Linnaeus, 1758)
Brassica oleracea L. var *botrytis* – Uttar Pradesh (Singh *et al.*, 2016)
Myzus (Nectarosiphon) persicae (Sulzer, 1776)
Solanum tuberosum L. – West Bengal (Nayak *et al.*, 2019)
Schoutedenia emblica (Patel & Kulkarni, 1952)
Phyllanthus emblica L. – Uttar Pradesh (Singh *et al.*, 2018)

9. *Peucetia latikae* Tikader, 1970
Aphis (Aphis) gossypii Glover, 1877
Gossypium hirsutum L. – Tamil Nadu (Jeyaparvathi *et al.*, 2013)

10. *Peucetia viridana* (Stoliczka, 1869)
Aphis (Aphis) craccivora Koch, 1854
Vigna radiata (L.) R.Wilczek – Rajasthan (Shukla & Tiwari, 2024)
Aphis (Aphis) gossypii Glover, 1877

Gossypium hirsutum L. – Tamil Nadu (Mathirajan & Reghupathy, 2003; Jeyaparvathi *et al.*, 2013); Telangana (Mallesh & Sravanthy, 2021)
Solanum melongena L. – Tamil Nadu (Sankari & Thiyagesan, 2010)
Trichosanthes cucumerina L. – Tamil Nadu (Sankari & Thiyagesan, 2010)

11. Unidentified species

Myzus (Nectarosiphon) persicae (Sulzer, 1776)
Brassica oleracea L. *capitata* – West Bengal (Anusha *et al.*, 2022)

K. Family Philodromidae: Philodromidae spiders are commonly known as false crab spiders, running crab spiders, house crab spiders etc. Most species live in the foliage, branches, stems of bushes and trees and even found running about at ground level. They do not construct webs but use silk for draglines which are used to drop from their perch and hang in the air (Singh & Singh, 2021c). At present, 48 species are known from India out of which only 2 species were recorded as aphid predators preying on only 3 aphid species infesting 4 food plants in only 3 states as mentioned below.

1. *Philodromus decoratus* Tikader, 1962

Brevicoryne brassicae (Linnaeus, 1758)
Raphanus sativus L. – Himachal Pradesh (Das & Raychaudhuri, 1983)

2. *Philodromus* sp.

Unidentified aphid
Pinus sp. – Himachal Pradesh (Agarwala *et al.*, 1981)

3. *Tibellus oblongus* (Walckenaer, 1802)

Myzus (Nectarosiphon) persicae (Sulzer, 1776)
5 *Solanum tuberosum* L. – West Bengal (Nayak *et al*., 2019)

4. *Tibellus* sp.

Sitobion (Sitobion) rosaeiformis (Das, 1918)
Rosa sp. – Uttarakhand (Debnath, 1991)

L. Family Salticidae: Salticidae includes jumping spiders and is the largest family of the order Araneae. In general, they do not construct web to capture prey, instead, they are master hunters, with the ability to jump vast distances feeding a large variety of preys (Singh *et al.*, 2021b). At present, 351 species of Salticidae are known from India (Singh *et al.*, 2023a) but only 11 species are known to prey 22 species of aphids infesting 23 species of plants in 10 states as mentioned below.

1. *Carrhotus viduus* (C.L. Koch 1846)

Unidentified aphid
Capsicum sp. – Karnataka (Hill *et al.*, 2021)

2. *Hyllus semicupreus* (Simon, 1885)

Aphis (Aphis) craccivora Koch, 1854
Vigna unguiculata (L.) Walp. – Madhya Pradesh (Upadhyay *et al.*, 2018a)
Rhopalosiphum maidis (Fitch, 1856)
Sorghum bicolor (L.) Moench – Maharashtra (Kale *et al.*, 2020)

3. *Marpissa* sp.

Acyrthosiphon (Acyrthosiphon) rubi Narzikulov, 1957
Rubus ellipticus Sm. – Uttarakhand (Debnath, 1991)
Aphis (Aphis) gossypii Glover, 1877
Solanum melongena L. – Odisha (Singh *et al*., 2023)
Aphis (Aphis) kurosawai Takahashi, 1921
Artemisia sp. – Uttarakhand (Debnath, 1991)
Chaitophorus kapuri Hille Ris Lambers, 1966

Populus ciliata Wall. ex Royle – Uttarakhand (Debnath, 1991)

Cinara (Cupressobium) tujafilina (del Guercio, 1909)

Cupressus sp. – West Bengal (Raychaudhuri *et al.*, 1979; Debnath, 2020)

Epipemphigus imaicus (Cholodkovsky, 1912)

Populus ciliata Wall. ex Royle – Uttarakhand (Debnath, 1991)

Eriosoma lanigerum (Hausmann, 1802)

Malus domestica (Suckow) Borkh. – Uttarakhand (Debnath, 1991)

Liosomaphis himalayensis Basu, 1964

Berberis aristata DC. – Uttarakhand (Debnath, 1991)

Lipaphis (Lipaphis) erysimi (Kaltenbach, 1843)

Brassica rapa L. – Uttarakhand (Debnath, 1991)

Melanaphis nr. *arundinariae* (Takahashi, 1937)

Pyrus pashia Buch.–Ham. ex D. Don – Uttarakhand (Debnath, 1991)

Mollitrichosiphum sp.

Alnus nepalensis D. Don – Uttarakhand (Debnath, 1991)

Pemphigus (Pemphigus) mordwilkoi Cholodkovsky, 1912

Populus ciliata Wall. ex Royle – Uttarakhand (Debnath, 1991)

Sitobion (Sitobion) miscanthi (Takahashi, 1921)

Triticum aestivum L. – Uttarakhand (Debnath, 1991)

4. *Myrmarachne* sp.

Brachycaudus (Brachycaudus) helichrysi (Kaltenbach, 1843)

Erigeron bonariensis L. – Uttarakhand (Debnath, 1991)

Capitophorus formosartemisiae (Takahashi, 1921)

Artemisia vulgaris L. – Uttarakhand (Debnath, 1991)

5. *Phidippus* sp.

Aphis (Aphis) gossypii Glover, 1877

Solanum melongena L. – Odisha (Singh *et al*., 2023)

Sitobion (Sitobion) miscanthi (Takahashi, 1921)

Triticum aestivum L. – Uttarakhand (Debnath, 1991)

6. *Phintella vittata* (C.L. Koch, 1846) [syn. *Salticus ranjitus* Tikader, 1967]

Lipaphis (Lipaphis) erysimi (Kaltenbach, 1843)

Brassica juncea (L.) Czern. – West Bengal (Ghosh, 1983)

Brassica sp. – West Bengal (Agarwala *et al.*, 1981)

7. *Plexippus paykulli* (Audouin, 1825)

Aphis (Aphis) craccivora Koch, 1854

Gossypium hirsutum L. – Gujarat (Sebastian & Sudhikumar, 2002)

Lipaphis (Lipaphis) erysimi (Kaltenbach, 1843)

Brassica oleracea L. – Maharashtra (Shaikh *et al.*, 2020)

Brassica rapa L. – Maharashtra (Shaikh *et al.*, 2020)

Raphanus sativus L. – Maharashtra (Shaikh *et al.*, 2020)

8. *Plexippus* sp.

Brevicoryne brassicae (Linnaeus, 1758)

Brassica rapa L. – Uttarakhand (Debnath, 1991)

Eriosoma lanigerum (Hausmann, 1802)

Malus domestica (Suckow) Borkh. – Uttarakhand (Debnath, 1991)

9. *Rhene flavigera* (C.L. Koch, 1846) [syn. *Rhene khandalaensis* Tikader, 1977]

Macrosiphum (Macrosiphum) rosae (Linnaeus, 1758)

Rosa sp. – West Bengal (Raychaudhuri *et al.*, 1978; Debnath, 2020)

10. *Rhene* sp.

Aphis (Aphis) gossypii Glover, 1877

Gossypium hirsutum L. – Telangana (Mallesh & Sravanthy, 2021)

11. *Salticus* sp.

Aphis (Aphis) gossypii Glover, 1877

Gossypium hirsutum L. – Tamil Nadu (Vanitha *et al.*, 2009)

12. *Telamonia dimidiata* (Simon, 1899) (syn. *Phidippus pateli* Tikader, 1974)

Aphis (Aphis) craccivora Koch, 1854

Gossypium hirsutum L. – Gujarat (Sebastian & Sudhikumar, 2002)

Aphis (Aphis) gossypii Glover, 1877

Abelmoschus esculentus Moench – Chhattisgarh (Chaturvedani *et al.*, 2023)

Unidentified aphid

Unidentified plant – Maharashtra (Patil *et al.*, 2018)

13. *Zygoballus* sp.

Melanaphis nr. *arundinariae* (Takahashi, 1937)

Pyrus pashia Buch.–Ham. ex D. Don – Uttarakhand (Debnath, 1991)

Mollitrichosiphum sp.

Alnus nepalensis D. Don – Uttarakhand (Debnath, 1991)

Myzus (Myzus) dycei Carver, 1961

Urtica dioica L. – Uttarakhand (Debnath, 1991)

Pemphigus (Pemphigus) mordwilkoi Cholodkovsky, 1912

Populus ciliata Wall. ex Royle – Uttarakhand (Debnath, 1991)

Sappaphis sp.

Cotoneaster bacillaris Wall. ex Lindl. – Uttarakhand (Debnath, 1991)

14. Unidentified species

Myzus (Nectarosiphon) persicae (Sulzer, 1776)

Brassica oleracea L. *capitata* – West Bengal (Anusha *et al.*, 2022)

M. Family Tetragnathidae: Tetragnathidae is commonly called as longed-jawed orb weavers, long-jawed spiders, stretch spiders or stilt spiders. These spiders spin more or less horizontal orb webs which are loosely woven with an open hub with few wide-set radii and spiral with no signal line or retreat. The spider usually sits in the centre of the web. These spiders are often found in vegetation near water. These long-jawed spiders restrain their active prey by grasping it with their legs and inject poison/digestive juices through fangs located at the tips of the chelicerae (Singh, 2021c). At present, 64 species are known from India (Singh *et al.*, 2023a), out of which only 4 species are known to prey on 7 species of aphids infesting 9 species of host plants in 6 states as given below.

1. *Leucauge celebesiana* (Walckenaer, 1841)

Aphis (Aphis) craccivora Koch, 1854

Lablab purpureus (L.) Sweet ssp. *purpureus* – Maharashtra (Kale *et al.*, 2020)

Aphis (Aphis) gossypii Glover, 1877

Galinsoga parviflora Cav. – West Bengal (Raychaudhuri *et al.*, 1979; Kale *et al.*, 2020)

Aphis (Aphis) pomi de Geer, 1773

Malus domestica (Suckow) Borkh. – Jammu & Kashmir (Khan, 2016)

Vicia faba L. – West Bengal (Debnath, 2020)

Uroleucon (Uromelan) compositae (Theobald, 1915)

Carthamus tinctorius L. – Maharashtra (Kale *et al.*, 2020)

Unidentified aphid

Unidentified plant – Maharashtra (Patil *et al.*, 2018)

2. *Leucauge decorata* (Blackwall, 1864)

Aphis (Aphis) craccivora Koch, 1854

Lablab purpureus (L.) Sweet ssp. *purpureus* – Maharashtra (Kale *et al.*, 2020)
Aphis (Aphis) gossypii Glover, 1877
Gossypium hirsutum L. – Tamil Nadu (Vanitha *et al.*, 2009)
Uroleucon (Uromelan) compositae (Theobald, 1915)
Carthamus tinctorius L. – Maharashtra (Kale *et al.*, 2020)

3. *Tetragnatha javana* (Thorell, 1890) [syn. *Eucta javana* Thorell, 1890]
Aphis (Aphis) gossypii Glover, 1877
Gossypium hirsutum L. – Tamil Nadu (Kannan *et al*., 2004)
Aphis (Aphis) spiraecola Patch, 1914
Solanum nigrum L. – Himachal Pradesh (Das & Raychaudhuri, 1983)

4. *Tetragnatha mandibulata* Walckenaer, 1841
Aphis (Aphis) craccivora Koch, 1854
Vigna unguiculata (L.) Walp. – Kerala (Manu, 2005)
Aphis (Aphis) gossypii Glover, 1877
Abelmoschus esculentus Moench – Kerala (Manu, 2005)

5. *Tetragnatha* sp.
Rhopalosiphum maidis (Fitch, 1856)
Sorghum bicolor (L.) Moench – Maharashtra (Kale *et al.*, 2020)

6. Unidentified species
Myzus (Nectarosiphon) persicae (Sulzer, 1776)
Brassica oleracea L. *capitata* – West Bengal (Anusha *et al.*, 2022)

N. Family Theridiidae: These spiders are commonly known as the cobweb spiders, tangle-web spiders, and comb-footed spiders and have a comb of serrated bristles on the tarsus of the fourth leg which is used to throw sticky silk over the prey to wrap them (Singh, 2021d). At present, 126 species of cobweb spiders are known from India (Singh *et al.*, 2023a), but only 4 species were recorded as aphidophagous preying on 18 species of aphids infesting 20 species of plants distributed in only 6 states/union territories as given below.

1. *Argyrodes* sp.
Aphis (Aphis) verbasci Schrank, 1801
Verbascum thapsus L. – Uttarakhand (Debnath, 1991)
Macrosiphoniella (Macrosiphoniella) sanborni (Gillette, 1908)
Chrysanthemum sp. – Uttarakhand (Debnath, 1991)

2. *Chrysso angula* (Tikader, 1970) [syn. *Theridula swatiae* Biswas, Saha & Raychaudhuri, 1997]
Cinara (Cupressobium) tujafilina (del Guercio, 1909)
Thuja sp. – West Bengal (Raychaudhuri *et al.*, 1998)

3. *Meotipa argyrodiformis* (Yaginuma, 1952)
Aphis (Aphis) gossypii Glover, 1877
Solanum melongena L. – Tamil Nadu (Sankari & Thiyagesan, 2010)
Trichosanthes cucumerina L. – Tamil Nadu (Sankari & Thiyagesan, 2010)

4. *Theridion manjithar* Tikader, 1970
Aphis (Aphis) craccivora Koch, 1854
Gossypium hirsutum L. – Gujarat (Sebastian & Sudhikumar, 2002)
Aphis (Aphis) pomi de Geer, 1773
Malus domestica (Suckow) Borkh. – Jammu & Kashmir (Khan, 2016)

5. *Theridion* sp.
Aphis (Aphis) craccivora Koch, 1854
Unidentified – West Bengal (Raychaudhuri *et al.*, 1979)

Aphis (Aphis) gossypii Glover, 1877
Zinnia sp. – Himachal Pradesh (Agarwala *et al.*, 1981)
Brachycaudus (Brachycaudus) helichrysi (Kaltenbach, 1843)
Prunus persica (L.) Batsch – Uttarakhand (Debnath, 1991)
Cinara (Cupressobium) tujafilina (del Guercio, 1909)
Cupressus sp. – West Bengal (Raychaudhuri *et al.*, 1978)
Hayhurstia atriplicis (Linnaeus, 1761)
Chenopodium album L. – Uttarakhand (Debnath, 1991)
Liosomaphis himalayensis Basu, 1964
Berberis aristata DC. – Uttarakhand (Debnath, 1991)
Lipaphis (Lipaphis) erysimi (Kaltenbach, 1843)
Brassica juncea (L.) Czern. – West Bengal (Ghosh, 1983)
Melanaphis nr. *arundinariae* (Takahashi, 1937)
Pyrus pashia Buch.–Ham. ex D. Don – Uttarakhand (Debnath, 1991)
Myzocallis (Globulicaudaphis) pakistanica (Hille Ris Lambers, 1966)
Quercus sp. – Himachal Pradesh (Das & Raychaudhuri, 1983)
Myzus (Myzus) dycei Carver, 1961
Urtica dioica L. – Uttarakhand (Debnath, 1991)
Nippolachnus sp.
Quercus sp. – Himachal Pradesh (Das & Raychaudhuri, 1983)
Pemphigus (Pemphigus) mordwilkoi Cholodkovsky, 1912
Populus ciliata Wall. ex Royle – Uttarakhand (Debnath, 1991)
Prociphilus sp.
Lonicera quinquelocularis Hardw. – Uttarakhand (Debnath, 1991)
Sappaphis sp.
Cotoneaster bacillaris Wall. ex Lindl. – Uttarakhand (Debnath, 1991)
Sitobion (Sitobion) miscanthi (Takahashi, 1921)
Triticum aestivum L. – Uttarakhand (Debnath, 1991)

O. Family Thomisidae: These spiders are commonly known as the crab spiders, flower spiders or flower crab spiders because of their crab-like appearance. Most of the species are found on vegetation. Crab spiders do not build web, rather capture the prey by ambushing and sometimes by active persuit. They are not active hunters but are sit-and-wait predators that hunt in flowers, foliage, or leaf litter. They remain impassive until the prey arrives and catches it (Singh G & Singh, 2021a). At present, 242 species are known in India (Singh *et al.*, 2023a), but only 12 species are aphidophagous preying on 18 species of aphids infesting 18 plant species distributed only in 6 states as mentioned below.

1. *Camaricus formosus* Thorell, 1887
Lipaphis (Lipaphis) erysimi (Kaltenbach, 1843)
Brassica rapa L. – West Bengal (Agarwala *et al.*, 1981)
Brassica juncea (L.) Czern. – West Bengal (Ghosh, 1983)

2. *Henriksenia hilaris* (Thorell, 1877) [syn. *Diaea jaintious* Tikader, 1966]
Aphis (Aphis) kurosawai Takahashi, 1921
Artemisia vulgaris L. – Uttarakhand (Debnath, 1991)

3. *Indoxysticus minutus* (Tikader, 1960) [syn. *Xysticus minutus* Tikader, 1960]
Myzus (Myzus) mumecola (Matsumura, 1917)
Unidentified plant – Himachal Pradesh (Das & Raychaudhuri, 1983)
Pterocallis (Pterocallis) affinis Chakrabarti, 1988
Corylus colurna L. – Uttarakhand (Debnath, 1991)

4. *Misumena* sp.

Macrosiphum (Macrosiphum) rosae (Linnaeus, 1758)

Rosa sp. – Himachal Pradesh (Das & Raychaudhuri, 1983)

Sitobion (Sitobion) rosaeiformis (Das, 1918)

Rosa sp. – Himachal Pradesh (Agarwala *et al.*, 1981)

5. *Misumenops khandalaensis* Tikader, 1965

Sitobion (Sitobion) indicum Basu, 1964

Unidentified grass – Himachal Pradesh (Das & Raychaudhuri, 1983)

6. *Ozyptila* sp.

Myzus (Myzus) ornatus (Laing, 1932)

Unidentified plant – Himachal Pradesh (Das & Raychaudhuri, 1983)

7. *Synema decoratum* Tikader, 1960

Aphis (Aphis) craccivora Koch, 1854

Vigna unguiculata (L.) Walp. – Madhya Pradesh (Upadhyay *et al.*, 2018b)

8. *Thomisus projectus* Tikader, 1960

Lipaphis (Lipaphis) erysimi (Kaltenbach, 1843)

Brassica oleracea L. – Maharashtra (Shaikh *et al.*, 2020)

Brassica rapa L. – Maharashtra (Shaikh *et al.*, 2020)

Raphanus sativus L. – Maharashtra (Shaikh *et al.*, 2020)

9. *Thomisus pugilis* Stoliczka, 1869

Aphis (Aphis) craccivora Koch, 1854

Gossypium hirsutum L. – Gujarat (Sebastian & Sudhikumar, 2002)

Lablab purpureus (L.) Sweet ssp. *purpureus* – West Bengal (Agarwala *et al.*, 1981)

Lipaphis (Lipaphis) erysimi (Kaltenbach, 1843)

Brassica juncea (L.) Czern. – West Bengal (Ghosh, 1983)

10. *Thomisus spectabilis* Doleschall, 1859

Aphis (Aphis) gossypii Glover, 1877

Gossypium hirsutum L. – Maharashtra (Nagrare *et al.*, 2015)

11. *Thomisus* sp.

Aphis (Aphis) gossypii Glover, 1877

Abelmoschus esculentus Moench – Maharashtra (Kale *et al.*, 2020)

Lipaphis (Lipaphis) erysimi (Kaltenbach, 1843)

Brassica rapa L. – Maharashtra (Kale *et al.*, 2020)

Macrosiphum (Macrosiphum) rosae (Linnaeus, 1758)

Rosa sp. – West Bengal (Raychaudhuri *et al.*, 1979; Debnath, 2020)

12. *Xysticus bengalensis* Tikader & Biswas, 1974

Uroleucon (Uroleucon) sonchi (Linnaeus, 1767)

Sonchus arvensis L. – Uttarakhand (Debnath, 1991)

13. *Xysticus croceus* Fox, 1937 (syn. *Xysticus sujatai* Tikader, 1962)

Aphis (Aphis) craccivora Koch, 1854

Gossypium hirsutum L. – Gujarat (Sebastian & Sudhikumar, 2002)

14. *Xysticus* sp.

Capitophorus formosartemisiae (Takahashi, 1921)

Artemisia vulgaris L. – Uttarakhand (Debnath, 1991)

Cavariella (Cavariella) indica Maity & Chakrabarti, 1982

Salix babylonica L. – Uttarakhand (Debnath, 1991)

Eriosoma lanigerum (Hausmann, 1802)

Malus domestica (Suckow) Borkh. – Uttarakhand (Debnath, 1991)

Eutrichosiphum khasyanum (Ghosh & Raychaudhuri, 1962)
Quercus sp. – Himachal Pradesh (Das & Raychaudhuri, 1983)
Liosomaphis himalayensis Basu, 1964
Berberis aristata DC. – Uttarakhand (Debnath, 1991)
Myzus (Myzus) ornatus (Laing, 1932)
Unidentified plant – Himachal Pradesh (Das & Raychaudhuri, 1983)
Prociphilus sp.
Pinus wallichiana A.B. Jacks. – Uttarakhand (Debnath, 1991)
Sitobion (Sitobion) miscanthi (Takahashi, 1921)
Triticum aestivum L. – Uttarakhand (Debnath, 1991)

P. Family Uloboridae: The spiders of the family Uloboridae are commonly known as the hackled-band orb-weavers as the spiral portion of the capturing web (in the form of orbs or portions of orbs) is spun by an unusual type of wooly silk thread known as hackled band. These spiders sometimes live in group with individual webs loosely connected. They lack poison glands and encase their prey thoroughly in silk covering it in regurgitated digestive juice, and then ingest the liquified body (Singh G & Singh, 2021b). In India, only 30 species are known, out of which only one species of spider is known to prey on 2 species of aphids infesting 3 species of plants only in West Bengal as mentioned below.

1. *Uloborus khasiensis* Tikader, 1969
Aphis (Aphis) gossypii Glover, 1877
Gossypium hirsutum L. – Gujarat (Dhulia & Yadav, 1991)

2. *Uloborus* sp.
Aphis (Aphis) gossypii Glover, 1877
Tagetes erecta L. – West Bengal (Raychaudhuri *et al.*, 1979; Debnath, 2020)
Cinara (Cupressobium) tujafilina (del Guercio, 1909)
Cupressus sp. – West Bengal (Raychaudhuri *et al.*, 1979)

Q. Unidentified species
Aphis (Aphis) craccivora Koch, 1854
Arachis hypogaea L. – Andhra Pradesh (Kumar *et al.*, 2023)
Pisum sativum L. – Gujarat (Chauhan *et al.*, 2023)
Aphis (Aphis) gossypii Glover, 1877
Abelmoschus esculentus Moench – Tamil Nadu (Shanthi *et al.*, 2020)
Gossypium hirsutum L. – Andhra Pradesh (Rajasekhar & Durga Prasad, 2018); Haryana (Kumar *et al.*, 2016)
Myzus (Nectarosiphon) persicae (Sulzer, 1776)
Solanum lycopersicum L. – Rajasthan (Khokhar & Rolania, 2021)

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Spider fauna of Chhattisgarh: An updated checklist of spiders of Chhattisgarh, India with new additions

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Abstract

Spiders are one of the diverse groups of arachnids having more than 52,300 valid species worldwide. This study provides a comprehensive assessment of the diversity and distribution of spider species in Chhattisgarh, India. The research combines field observations and a thorough analysis of published literature and documented a total of 222 spider species from 96 genera of 23 families from the state of Chhattisgarh. The family Araneidae exhibited the highest species richness, with 49 species, followed by the families Thomisidae and Gnaphosidae which represented 32 and 31 species respectively. In the present study, 69 spider species have been documented, out of which 41 were previously unrecorded from the state. The findings of this research highlight the limited knowledge regarding spider distribution and diversity in Chhattisgarh. Several spider families have yet to be documented in the region. It is crucial to conduct in-depth surveys to comprehensively document the spider fauna in Chhattisgarh. Photographs of some important spider species found in Chhattisgarh are presented too in an appendix.

Keywords: Arachnida, Diversity, Araneomorphae, Faunal diversity.

Introduction

Spiders are predators by nature and feed on a wide range of insects, including invertebrates and small vertebrates; they play a vital role in maintaining ecosystem function and environmental health. Spiders have spread to almost every type of terrestrial environment (Except for Antarctica) with various guild structures and regional adaptation

(Abdullah *et al.*, 2019; Choudhury *et al.*, 2019). According to estimates, the spider community throughout the world consumes 400-800 million tons of insects annually which regulate insect populations that may otherwise harm crop production (Nyffeler & Birkhofer, 2017). In the absence of spiders, the world would face serious problems that would influence the terrestrial food chain and cause ecosystem imbalance; regardless of the fact their study has always been neglected (Samiayyan, 2014). The spiders' benefits by regulating pest species are well documented but studies on spiders in general are still very less.

Spiders (Order: Araneae) are one of the most diverse orders of invertebrates and are ranked seventh largest order in terms of biodiversity worldwide (R. Singh & Singh, 2022). There are 52,205 accepted species from 4391 genera of 135 families described worldwide with an average annual addition of 800 to 1000 new species descriptions (World Spider Catalog, 2024). In the recent past, various families and genera have been revised due to which some species have been synonymised and some new species have been described.

In India before Tikader (1980, 1982) many families of spiders had not been explored in central India. Spider from Madhya Pradesh and Chhattisgarh was documented by Gajbe, U. (1983-99) out of which most of the species are described from Madhya Pradesh (Patil, 2011). The present checklist is an attempt to update the list of spider fauna in Chhattisgarh, India.

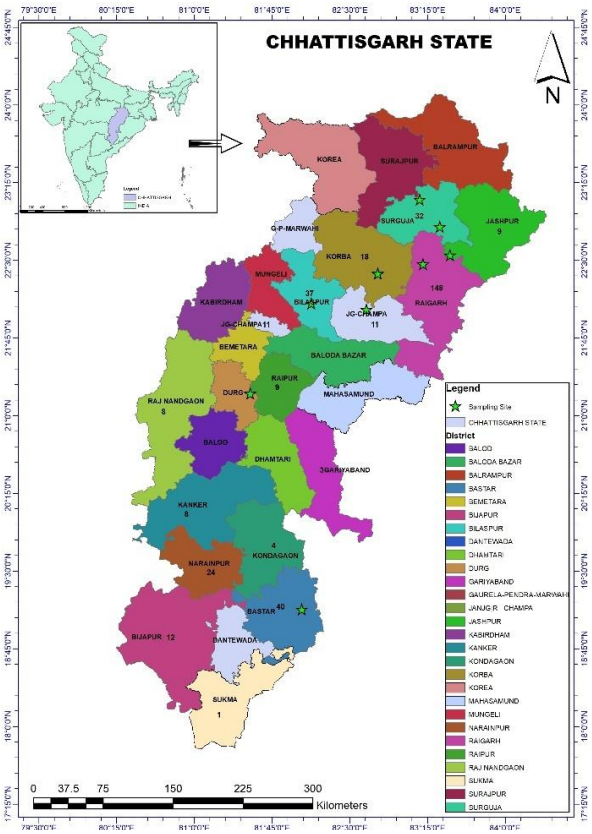

Fig. 1. Study area with sampling site locations (stars).

Material and Methods

***Study area*:** The central Indian state of Chhattisgarh with coordinates 21.2787°N, 81.8661°E has an area of 1,35,192 square kilometres (Fig. 1) (Bhuarya *et al.*, 2018). The

state is surrounded by Orissa, Madhya Pradesh, Telangana, Jharkhand, and Maharashtra. This state has rich biodiversity because about 41% of its area is covered by forests. The forest covers predominantly a mixture of tropical dry deciduous and moist deciduous forest. Chhattisgarh is predominantly a plateau region, with the Maikal Range in the north and the Bastar Plateau in the south. These plateaus are covered in dense forests and are known for their scenic beauty and rich biodiversity. The central part and southern parts of Chhattisgarh have significant forest cover. The geography of the area provides several habitats and microhabitats for the microfauna.

Chhattisgarh has a tropical climate. Due to its proximity to the Tropic of Cancer and reliance on the monsoons for rain, it is hot and humid. In Chhattisgarh, the summertime high can reach 45°C. Most of the rain is in the monsoon season, which lasts from late June to October. The average annual rainfall in Chhattisgarh is 1,292 millimetres. From November to January is winter. Winters are pleasant With low humidity and moderate temperatures (Bhuarya *et al.*, 2018).

***Methodology*:** The current study is based on the collected field data and published literature on spiders, i.e., research papers, book chapters, Records, World Spider Catalog (WSC) and fauna series of the ZSI. Several field visits were conducted in different parts of Chhattisgarh, India from February 2023 to May 2024. In the present study along with the addition of new spider fauna to Chhattisgarh, the documentation of existing literature on spiders in Chhattisgarh was also carried out. Some of the literature published has errors in the scientific names and also due to the revision of taxa, the status of various taxa has been modified in the recent past. Therefore, in the present checklist we attempt to correct errors in the scientific names of the spiders following World Spider Catalog (2024). In the study, if a spider species is identified only up to genus level it was classified in a separate table.

The collecting of specimens was done using various sampling methods, viz, vegetation beating, pitfall trapping, sweep netting, hand picking, and leaf litter sampling (Hore & Uniyal, 2008). Due to the large study area, it is not possible to cover all the habitat types. There are nine sites where the sampling activity was conducted (Fig. 1). After collecting, the specimens were preserved in 70% alcohol. For species-level identification, specimens were examined under the stereo-zoom microscope. Due to the unavailability of a mounted camera on the microscope, the identifying photographs under the microscope were not available. Identification of spider was done using different publications, and the World Spider Catalog. The map of the study area and sampling site was carried out with ArcGIS 10.3 (Fig. 1). Photographs of some important spider species found in Chhattisgarh, India are presented too (Appendix 1).

Results and Discussion

In the year 2000, the state of Chhattisgarh (CG) was carved out from the state of Madhya Pradesh (MP). From the literature review, it was found that before 1980 no work had been done on spider fauna in present-day CG. B.K. Tikader studied many families of spiders from central India. Afterward, Spider from MP and Chhattisgarh were mainly studied by Gajbe U. (1983-1999) of which most of the specimens were described from MP only. In the book "Fauna of Indravati Tiger Reserve Madhya Pradesh" (Ghosh, 1995) Gajbe reported 13 spider species from 10 genera of 4 families from the southern part of Chhattisgarh. In 2011 Patil reviewed spiders of MP and CG and reported 214 species from 68 families from Central India. Out of the 214 species, around 70% of species were

only reported from the state of Madhya Pradesh because most of the studies were done in the nearby region of Jabalpur and in some protected areas of MP (Patil, 2011).

After 2010, less number of taxonomic grade publications from the CG, and only some checklists were reported (Ekka & Kujur, 2015; Kujur & Ekka, 2012, 2016a, 2016b; Sen, 2021). All the published checklists by Kujur & Ekka were from the nearby region of Raigarh, CG and in some cases listed up to the generic level. On the other hand, the study by Sen (2021) studied spider diversity in the Gariaband district of CG and found 13 species from 8 families which was insignificant as compared to its study area. The number of species may not be near to the actual spider diversity of the area. The review of spiders in Chhattisgarh was done by (Singh & Singh, 2021), which reported 179 species belonging to 21 families and noted no spider faunal survey, it was done in most of the parts of the state. Out of 179 species documented, 165 were reported from Raigarh district only. Most parts of the CG are still unexplored.

Table 1. Spider checklist of Chhattisgarh.

Family/Genus	Species	Reported from	References
1. Agelenidae C.L. Koch, 1837			
Agelena Walckenaer, 1805	*Agelena gautami* Tikader, 1962	Mungeli	Toppo *et al.*, 2020
	Agelena inda Simon, 1897	Mungeli	Toppo *et al.*, 2020
Tegenaria Latreille, 1804	*Tegenaria comstocki* Gajbe, 2004	Raigarh	Kujur & Ekka, 2012, Ekka & Kujur, 2015, Toppo *et al.*, 2020
2. Araneidae Clerck, 1757			
Anepsion Strand, 1929	*Anepsion maritatum* (O. Pickard-Cambridge, 1877)	Bilaspur, Sarguja	PS
Araneus Clerk, 1757	*Araneus bastarensis* Gajbe, 2005	Bastar	Gajbe, 2005a
	Araneus camilla (Simon, 1889)	Mungeli	Toppo *et al.*, 2020
Araniella Chamberlin & lvie, 1942	*Araniella nympha* (Simon, 1889)	Raigarh	Kujur & Ekka, 2012, 2016a, 2016b; Ekka & Kujur, 2015; Toppo *et al.*, 2020
Argiope Savigny, 1825	*Argiope aemula* (Walckenaer, 1841)	Bijapur, Kanker, Narayanpur, Raigarh, Mungeli, Korba, Champa	Gajbe, 1995, 2003, 2005a; Kujur & Ekka, 2012, 2016a; Ekka & Kujur, 2015; Toppo *et al.*, 2020; PS
	Argiope anasuja Thorell, 1887	Bastar, Bilaspur	Gajbe, 2005a; PS
	Argiope catenulata (Doleschall, 1859)	Mungeli, Bastar, Champa	Toppo *et al.*, 2020; PS
	Argiope minuta Karsch, 1879	Mungeli	Toppo *et al.*, 2020

	Argiope pulchella Thorell, 1881	Bijapur, Narayanpur, Raigarh, Mungeli, Raipur, Sarguja, Bilaspur, Pathalgaon	Gajbe, 1995; Gajbe 2007; Kujur & Ekka, 2012, 2016a, 2016b; Ekka & Kujur, 2015; Toppo *et al.*, 2020; PS
	Argiope trifasciata (Forskål, 1775)	Bastar	Gajbe, 1995; Gajbe, 2007
Bijoaraneus Tanikawa, Yamasaki & Petcharad, 2021	*Bijoaraneus mitificus* (Simon, 1886)	Bastar, Narayanpur, Raigarh	Gajbe, 2007; Gajbe, 2005a; Kujur & Ekka, 2012, 2016a, 2016b; Ekka & Kujur, 2015; PS
Cyclosa Menge, 1866	*Cyclosa bifida* (Doleschall, 1859)	Raigarh, Bilaspur, Sarguja	Kujur & Ekka, 2016b; PS
	Cyclosa confraga (Thorell, 1893)	Raigarh, Bilaspur	Kujur & Ekka, 2012, 2016a, 2016b; Ekka & Kujur, 2015; PS
	Cyclosa hexatuberculata Tikader, 1982	Bastar, Bijapur, Narayanpur, Raigarh, Bilaspur	Gajbe, 1995; Gajbe, 2007; Ekka & Kujur, 2015; Kujur & Ekka, 2016b; PS
	Cyclosa insulana (Costa, 1834)	Raigarh	Kujur & Ekka, 2012, 2016a
	Cyclosa moonduensis Tikader, 1963	Raigarh, Sarguja	Kujur & Ekka, 2012, 2016a; Ekka & Kujur, 2015; PS
	Cyclosa spirifera Simon, 1889	Bastar	Gajbe, 2004
	Cyrtophora bidenta Tikader, 1970	Raigarh	Ekka & Kujur, 2015; Kujur & Ekka, 2016b
	Cyrtophora citricola (Forskål, 1775)	Sarguja	PS
Cyrtarachne Thorell, 1868	*Cyrtarachne inaequalis* Thorell, 1895	Sarguja, Champa, Raipur	PS
Cyrtophora Simon, 1864	*Cyrtophora jabalpurensis* Gajbe & Gajbe, 1999	Raigarh	Ekka & Kujur, 2015, Kujur & Ekka, 2016a
	Cyrtophora moluccensis (Doleschall, 1857)	Sarguja	PS
Eriovixia Archer, 1951	*Eriovixia excelsa* (Simon, 1889)	Raigarh, Bastar, Pathalgaon	Kujur & Ekka, 2012; Ekka & Kujur, 2015; PS
	Eriovixia laglaizei (Simon, 1877)	Bilaspur, Raigarh	PS
Gasteracantha Sundevall, 1833	*Gasteracantha geminata* (Fabricius, 1798)	Sarguja, Bilaspur, Raigarh	PS

	Gasteracantha kuhli C.L. Koch, 1837	Bilaspur, Raigarh	PS
Gibbaranea Archer, 1951	*Gibbaranea bituberculata* (Walckenaer, 1802)	Bilaspur, Raigarh	PS
Guizygiella Zhu, Kim & Song, 1997	*Guizygiella indica* (Tikader & Bal, 1980)	Raigarh	Ekka & Kujur, 2015
Herennia Thorell, 1877	*Herennia multipuncta* (Doleschall, 1859)	Bastar, Narayanpur	Gajbe, 2005a; Toppo *et al.*, 2020; PS
Larinia Simon, 1874	*Larinia bharatae* Bhandari & Gajbe, 2001	Raigarh	Kujur & Ekka, 2012, 2016a; Ekka & Kujur, 2015
	Larinia chloris (Savigny, 1825)	Raipur, Bastar	PS
	Larinia emertoni Gajbe & Gajbe, 2004	Raigarh	Kujur & Ekka, 2016a
	Larinia phthisica (L. Koch, 1871)	Sarguja	PS
Macracantha Simon, 1864	*Macracantha hasselti* (C.L. Koch, 1837)	Bilaspur, Sarguja, Korba	PS
Neoscona Simon, 1864	*Neoscona bengalensis* Tikader & Bal, 1981	Raigarh	Kujur & Ekka, 2012, 2016a, 2016b; Ekka & Kujur, 2015
	Neoscona biswasi Bhandari & Gajbe, 2001	Raigarh	Kujur & Ekka, 2016a
	Neoscona molemensis Tikader & Bal, 1981	Bastar	Gajbe, 2005a
	Neoscona mukerjei Tikader, 1980	Bastar, Kanker, Raigarh	Gajbe, 1995; Gajbe, 2003; Kujur & Ekka, 2012, 2016a
	Neoscona nautica (L. Koch, 1875)	Raigarh, Bastar, Pathalgaon	Kujur & Ekka, 2012, 2016a; Ekka & Kujur, 2015; PS
	Neoscona pavida (Simon, 1906)	Raigarh	Ekka & Kujur, 2015; Kujur & Ekka, 2016a, 2016b
	Neoscona punctigera (Doleschall, 1857)	Bastar, Sarguja	PS
	Neoscona sanghi Gajbe, 2004	Raigarh	Kujur & Ekka, 2012, 2016a; Ekka & Kujur, 2015
	Neoscona sanjivani Gajbe, 2004	Raigarh	Ekka & Kujur, 2015
	Neoscona sinhagadensis (Tikader, 1975)	Bilaspur, Champa, Pathalgaon	Gajbe, 2003

	Neoscona theisi (Walckenaer, 1841)	Raigarh	Gajbe, 2003; Kujur & Ekka, 2016a; PS
Nephila Leach, 1815	*Nephila pilipes* (Fabricius, 1793)	Raigarh, Mungeli, Pathalgaon	Kujur & Ekka, 2012, 2016a; Toppo *et al.*, 2020; PS
Parawixia F.O. Pickard-Cambridge, 1904	*Parawixia dehaani* (Doleschall, 1859)	Bilaspur, Raigarh, Champa, Pathalgaon	PS
Thelacantha van Hasselt, 1882	*Thelacantha brevispina* (Doleschall, 1857)	Raigarh, Korba, Champa, Sarguja	PS
Trichonephila Dahl, 1911	*Trichonephila clavata* (L. Koch, 1878)	Raigarh	Kujur & Ekka, 2012, 2016a; Ekka & Kujur, 2015
3. Cithaeronidae Simon, 1893			
Cithaeron O. Pickard-Cambridge, 1872	*Cithaeron indicus* Platnick & Gajbe, 1994	Rajnandgaon	Platnick & Gajbe, 1994
4. Clubionidae Simon, 1878			
Clubiona Latreille, 1804	*Clubiona drassodes* O. Picard-Cambridge, 1874	Raigarh	Kujur & Ekka, 2016a
	Clubiona filicata O. Picard-Cambridge, 1874	Bilaspur, Korba	PS
5. Corinnidae Karsch, 1880			
Corinnomma Karsch, 1880	*Corinnomma severum* (Thorell, 1877)	Bilaspur, Raigarh	PS
6. Eresidae C.L. Koch, 1845			
Stegodyphus Simon, 1873	*Stegodyphus sarsinorum* Karsch, 1892	Bastar, Narayanpur, Raigarh, Rajnandgaon, Sarguja	Gajbe & Sharma, 1994; Gajbe PU, 2004; Gajbe 2004a, 2007; Kujur & Ekka, 2016a; PS
7. Filistatidae Ausserer, 1867			
Pritha Lehtinen, 1967	*Pritha poonaensis* (Tikader, 1963)	Bastar, Narayanpur, Raigarh	Gajbe & Sharma, 1994; Gajbe, 2007; Kujur & Ekka, 2016a
8. Gnaphosidae Banks, 1892			
Callilepis Westring, 1874	*Callilepis chakanensis* Tikader , 1982	Raigarh	Kujur & Ekka, 2012; Ekka & Kujur, 2015
	Callilepis lambai Tikader & Gajbe, 1977	Kondagaon, Raigarh	Gajbe, 1995, 2007; Gajbe, 2007; Kujur & Ekka, 2016a

	Callilepis rukminiae Tikader & Gajbe, 1977	Raigarh	Kujur & Ekka, 2016a
Cryptodrassus Miller, 1943	*Cryptodrassus khajuriai* (Tikader & Gajbe, 1976)	Raigarh	Kujur & Ekka, 2012, 2016a; Ekka & Kujur, 2015
Drassodes Westring, 1851	*Drassodes himalayensis* Tikader & Gajbe, 1975	Sarguja	Gajbe, 1988
	Drassodes lophognathus Purcell, 1907	Raigarh	Kujur & Ekka, 2016a
	Drassodes luridus (O. Pickard-Cambridge, 1874)	Kondagaon, Raigarh	Gajbe, 1995, 2007
	Drassodes meghalayaensis Tikader & Gajbe, 1977	Raigarh	Kujur & Ekka, 2016a
	Drassodes narayanpurensis Gajbe, 2005	Narayanpur	Gajbe, 2005b
	Drassodes pashanensis Tikader & Gajbe, 1977	*Bastar*	Gajbe, 2007
	Drassodes sagarensis Tikader, 1982	Raigarh	Kujur & Ekka, 2012; Ekka & Kujur, 2015
	Drassodes tikaderi (Gajbe, 1987)	Raigarh	Kujur & Ekka, 2012, 2016a; Ekka & Kujur, 2015
Gnaphosa Latreille, 1804	*Gnaphosa jodhpurensis* Tikader & Gajbe, 1977	Raigarh	Kujur & Ekka, 2012, 2016a
	Gnaphosa pauriensis Tikader & Gajbe, 1977	Bastar, Raigarh	Gajbe, 2003; Ekka & Kujur, 2015
	Gnaphosa poonaensis Tikader, 1973	Raigarh	Kujur & Ekka, 2012, 2016a; Ekka & Kujur, 2015
Haplodrassus Chamberlin, 1922	*Haplodrassus sataraensis* Tikader & Gajbe, 1977	Bastar, Narayanpur	Gajbe, 1988, 2005b, 2007
Hitobia Kamura, 1992	*Hitobia meghalayensis* (Tikader & Gajbe, 1976)	Raigarh	Kujur & Ekka, 2016a
	Hitobia poonaensis (Tikader & Gajbe, 1976)	Raigarh, Rajnandgaon	Gajbe, 2003; Ekka & Kujur, 2015; Kujur & Ekka, 2016a
	Hitobia singhi (Tikader & Gajbe, 1976)	Raigarh	Kujur & Ekka, 2016a
Megamyrmaekion Reuss, 1834	*Megamyrmaekion tikaderi* (Gajbe, 1987)	Bastar, Raigarh	Gajbe, 2003; Kujur & Ekka, 2016a
Poecilochroa Westring, 1874	*Poecilochroa barmani* Tikader, 1982	Raigarh	Kujur & Ekka, 2016a
	Poecilochroa tikaderi Patel, 1989	Raigarh	Kujur & Ekka, 2016a

Scotophaeus Simon, 1893	*Scotophaeus goaensis* (Tikader, 1982)	Raigarh, Sarguja	Gajbe, 2005b, 2007; Kujur & Ekka, 2012; Ekka & Kujur, 2015
Setaphis Simon, 1893	*Setaphis subtilis* (Simon, 1897)	Sarguja	Gajbe, 1988, 2007
Zelotes Gistel, 1848	*Zelotes bharatae* Gajbe, 2005	Raigarh	Kujur & Ekka, 2016a
	Zelotes jabalpurensis Tikader & Gajbe, 1976	Raigarh	Kujur & Ekka, 2012, 2016a
	Zelotes poonaensis Tikader & Gajbe, 1976	Raigarh	Kujur & Ekka, 2016a
	Zelotes sataraensis Tikader & Gajbe, 1979	Narayanpur	Gajbe, 2005b, 2007
	Zelotes shantae Tikader, 1982	Narayanpur	Gajbe & Sharma, 1994
	Zelotes viveki Gajbe, 2005	Bastar	Gajbe, 2005b
	Zelotes yogeshi Gajbe, 2005	Bastar, Rajnandgaon	Gajbe, 2004a, 2005b; Kujur & Ekka, 2012; Ekka & Kujur, 2015
9. Hersiliidae Thorell, 1869			
Hersilia Savigny, 1825	*Hersilia savignyi* Lucas, 1836	Bastar, Narayanpur, Raigarh, Rajnandgaon, Bilaspur, Korba	Gajbe, 1992a; Gajbe & Sharma, 1994; Gajbe, 2004a, 2007; Kujur & Ekka, 2016a; Ekka & Kujur, 2015; PS
10. Liocranidae Simon, 1897			
Agroeca Westring, 1861	*Agroeca tikaderi* (Gajbe, 1992)	Narayanpur	Gajbe, 1992b, 2007
Oedignatha Thorell, 1881	*Oedignatha scrobiculata* Thorell, 1881	Korba	PS
Sphingius Thorell, 1890	*Sphingius barkudensis* Gravely, 1931	Raigarh	Kujur & Ekka, 2012, 2016a
11. Lycosidae Sundevall, 1833			
Arctosa C.L. Koch, 1847	*Arctosa himalayensis* Tikader & Malhotra, 1980	Kanker, Raigarh, Rajnandgaon	Gajbe & Sharma, 1994; Gajbe, 2004b; Kujur & Ekka, 2012, 2016a; Ekka & Kujur, 2015
	Arctosa indica Tikader & Malhotra, 1980	Raigarh	Ekka & Kujur, 2015; Kujur & Ekka, 2016a
Draposa Kronestedt, 2010	*Draposa amkhasensis* (Tikader & Malhotra, 1976)	Raigarh	Kujur & Ekka, 2012, 2016a
	Draposa porpaensis (Gajbe, 2004)	Bastar	Gajbe, 2004b

Hippasa Simon, 1885	*Hippasa agelenoides* (Simon 1884)	Bijapur, Kanker, Narayanpur, Raigarh, Mungeli	Gajbe & Sharma, 1994; Gajbe, 1995, 2003; Kujur & Ekka, 2012, 2016a, 2016b; Toppo *et al.*, 2020
	Hippasa deserticola Simon, 1889	Bastar	Gajbe, 2004b
	Hippasa partita (O. Pickard-Cambridge, 1876)	Bastar	Gajbe, 2004b
Lycosa Latreille, 1804	*Lycosa bistriata* Gravely, 1924	Raigarh	Kujur & Ekka, 2016a
	Lycosa jagadalpurensis Gajbe, 2004	Bastar, Raigarh	Gajbe, 2004b; Kujur & Ekka, 2012, 2016a
	Lycosa nigrotibialis Simon, 1884	Bijapur, Kondagaon	Gajbe & Sharma, 1994
	Lycosa pictula Pocock, 1901	Mungeli	Toppo *et al.*, 2020
	Lycosa poonaensis Tikader & Malhotra, 1980	Bastar, Bijapur, Raigarh	Gajbe & Sharma, 1994; Gajbe, 1995; Kujur & Ekka, 2012, 2016a
	Lycosa shaktae Bhandari & Gajbe, 2001	Raigarh	Kujur & Ekka, 2012, 2016a
	Lycosa tista Tikader, 1970	Mungeli	Toppo *et al.*, 2020
Pardosa C.L. Koch, 1847	*Pardosa bargaonensis* Gajbe, 2004	Narayanpur	Gajbe, 2004b
	Pardosa jabalpurensis Gajbe & Gajbe, 1999	Raigarh	Kujur & Ekka, 2012, 2016a; Ekka & Kujur, 2015
	Pardosa mukundi Tikader & Malhotra, 1980	Raigarh	Kujur & Ekka, 2016a
	Pardosa orcchaensis Gajbe, 2004	Bastar	Gajbe, 2004b
	Pardosa pseudoannulata (Bösenberg & Strand, 1906)	Sarguja, Pathalgaon	PS
	Pardosa ranjani Gajbe, 2004	Raigarh	Kujur & Ekka, 2012, 2016a
	Pardosa sumatrana (Thorell, 1890)	Bijapur, Narayanpur	Gajbe & Sharma, 1994; Gajbe, 1995
	Pardosa tappaensis Gajbe, 2004	Rajnandgaon	Gajbe, 2004b
	Pardosa timidula (Roewer, 1951)	Raigarh	Kujur & Ekka, 2016a
Wadicosa Zyuzin, 1985	*Wadicosa fidelis* (O. Pickard-Cambridge, 1872)	Bastar, Bijapur, Kanker, Narayanpur, Raigarh, Mungeli	Gajbe & Sharma, 1994; Gajbe, 1995; Kujur & Ekka, 2016a, 2016b; Toppo *et al.*, 2020

12. Oonopidae Simon, 1890			
Triaeris Simon, 1892	*Triaeris barela* Gajbe, 2004	Raigarh	Ekka & Kujur, 2015
13. Oxyopidae Thorell, 1869			
Oxyopes Latreille, 1804	*Oxyopes ashae* Gajbe, 1999	Bastar, Raigarh	Gajbe, 1999, 2008; Kujur & Ekka, 2016a
	Oxyopes bharatae Gajbe, 1999	Raigarh	Ekka & Kujur, 2015; Kujur & Ekka, 2016a
	Oxyopes hindostanicus Pocock, 1901	Raigarh	Kujur & Ekka, 2016a
	Oxyopes hotingchiehi Schenkel, 1963	Sarguja	PS
	Oxyopes jabalpurensis Gajbe & Gajbe, 1999	Raigarh	Kujur & Ekka, 2012, 2016a; Ekka & Kujur, 2015
	Oxyopes kamalae Gajbe, 1999	Raigarh	Kujur & Ekka, 2012; Ekka & Kujur, 2015
	Oxyopes ketani Gajbe & Gajbe, 1999	Raigarh	Kujur & Ekka, 2012; Ekka & Kujur, 2015
	Oxyopes kusumae Gajbe, 1999	Raigarh	Ekka & Kujur, 2015
	Oxyopes naliniae Gajbe, 1999	Narayanpur, Raigarh	Gajbe, 1999; Kujur & Ekka, 2016a
	Oxyopes rukminiae Gajbe, 1999	Bastar, Raigarh	Gajbe, 1999, 2008; Kujur & Ekka, 2016a
	Oxyopes sakuntalae Tikader, 1970	Kondagaon	Gajbe, 2007
	Oxyopes shweta Tikader, 1970	Pathalgaon, Champa, Sarguja, Bilaspur	PS
	Oxyopes sunandae Tikader 1970	Bijapur	Gajbe, 2007
Peucetia Thorell, 1869	*Peucetia ashae* Gajbe & Gajbe, 1999	Raigarh	Kujur & Ekka, 2012; Ekka & Kujur, 2015
	Peucetia jabalpurensis Gajbe & Gajbe, 1999	Raigarh	Kujur & Ekka, 2012, 2016a; Ekka & Kujur, 2015
	Peucetia pawani Gajbe, 1999	Bastar, Raigarh	Gajbe, 1999; Kujur & Ekka, 2016a
	Peucetia rajani Gajbe, 1999	Bastar	Gajbe, 1999
	Peucetia viridana (Stoliczka, 1869)	Bilaspur, Raipur	PS
	Peucetia viveki Gajbe, 1999	Raigarh	Ekka & Kujur, 2015

	Peucetia yogeshi Gajbe, 1999	Narayanpur, Raigarh	Gajbe, 1999, 2008; Kujur & Ekka, 2016a
14. Philodromidae Thorell, 1869			
Philodromus Walcakenaer, 1826	*Philodromus ashae* Gajbe & Gajbe, 1999	Raigarh	Kujur & Ekka, 2012, 2016a
	Philodromus barmani Tikader, 1980	Raigarh	Kujur & Ekka, 2016a
	Philodromus bhagirathai Tikader, 1966	Kanker, Raigarh	Gajbe & Sharma, 1994; Kujur & Ekka, 2012, 2016a
	Philodromus cespitum (Walckenaer, 1802)	Gariaband	Sen, 2021
	Philodromus domesticus Tikader, 1962	Raigarh	Ekka & Kujur, 2015; Kujur & Ekka, 2016a
	Philodromus jabalpurensis Gajbe & Gajbe, 1999	Raigarh	Kujur & Ekka, 2012, 2016a; Ekka & Kujur, 2015
	Philodromus pali Gajbe & Gajbe, 2001	Raigarh	Kujur & Ekka, 2016a
Thanatus C.L. Koch, 1837	*Thanatus jabalpurensis* Gajbe & Gajbe, 1999	Raigarh	Kujur & Ekka, 2012, 2016a; Ekka & Kujur, 2015
	Thanatus ketani Bhandari & Gajbe, 2001	Raigarh	Kujur & Ekka, 2012, 2016a; Ekka & Kujur, 2015
Tibellus Simon, 1875	*Tibellus jabalpurensis* Gajbe & Gajbe, 1999	Raigarh	Kujur & Ekka, 2012, 2016a; Ekka & Kujur, 2015
	Tibellus poonaensis Tikader, 1962	Raigarh	Kujur & Ekka, 2016a
15. Pholcidae C.L. Koch, 1850			
Crossopriza Simon, 1893	*Crossopriza lyoni* (Blackwall, 1867)	Champa, Bilaspur	PS
Holocnemus Simon, 1873	*Holocnemus pluchei* (Scopoli, 1763)	Gariaband	Sen, 2021
Micropholcus Deeleman-Reinhold & Prinsen, 1987	*Micropholcus fauroti* (Simon, 1887)	Bilaspur	PS
Pholcus Walckenaer, 1805	*Pholcus phalangioides* (Fuesslin, 1775)	Gariaband	Sen, 2021
16. Pisauridae Simon, 1890			
Nilus O. Pickard-Cambridge, 1876	*Nilus phipsoni* (F.O. Pickard-Cambridge, 1898)	Champa, Sarguja	PS

Perenethis L. Koch, 1878	*Perenethis venusta* L. Koch, 1878	Champa, Raipur, Sarguja	PS
17. Salticidae Blackwall, 1841			
Asemonea O. Pickard-Cambridge, 1869	Asemonea tenuipes (O. Pickard-Cambridge, 1869)	Mungeli	Toppo *et al.*, 2020
Bianor G.W Pecham & E.G. Peckham, 1886	*Bianor albobimaculatus* (Lucas, 1846)	Bilaspur, Korba	PS
	Bianor angulosus (Karsch, 1879)	Raigarh	Kujur & Ekka, 2016a
Carrhotus Thorell, 1891	*Carrhotus viduus* (C.L. Koch, 1846)	Mungeli, Bilaspur	Toppo *et al.*, 2020; PS
Chrysilla Thorell, 1887	*Chrysilla volupe* (Karsch, 1879)	Bilaspur, Raigarh, Korba	PS
Harmochirus Simon, 1886	*Harmochirus brachiatus* (Thorell, 1877)	Korba	PS
Hasarius Simon, 1871	*Hasarius adansoni* (Audouin, 1825)	Mungeli, Raipur, Bastar	Toppo *et al.*, 2020; PS
Hyllus C.L. Koch, 1846	*Hyllus semicupreus* (Simon, 1885)	Mungeli, Bilaspur	Toppo *et al.*, 2020; PS
Menemerus Simon, 1868	*Menemerus bivittatus* (Dufour, 1831)	Mungeli, Sarguja, Korba	Toppo *et al.*, 2020; PS
Myrmaplata Prószyński, 2016	*Myrmaplata plataleoides* (O. Pickard-Cambridge, 1869)	Raigarh, Bilaspur, Sarguja	PS
Phidippus C.L. Koch, , 1846	*Phidippus bhimrakshiti* Gajbe, 2004	Raigarh	Kujur & Ekka, 2012, 2016a; Ekka & Kujur, 2015
Phintella Strand, 1906	*Phintella vittata* (C.L. Koch, 1846)	Bilaspur, Korba, Sarguja, Raigarh	PS
Plexippus C.L. Koch, 1846	*Plexippus paykulli* (Audouin, 1825)	Raigarh, Mungeli	Kujur & Ekka, 2016a, 2016b; Toppo *et al.*, 2020; PS
	Plexippus petersi (Karsch, 1878)	Raipur	PS
Portia Karsch, 1878	*Portia fimbriata* (Doleschall, 1859)	Korba	PS
Rhene Thorell,1869	*Rhene albigera* (C.L. Koch, 1846)	Bilaspur, Champa	PS
	Rhene flavigera (C.L. Koch, 1846)	Raigarh, Bilaspur	Kujur & Ekka, 2012; Ekka & Kujur, 2015; PS
Telamonia Thorell, 1887	*Telamonia dimidiata* (Simon, 1899)	Mungeli, Korba, Bilaspur	Toppo *et al.*, 2020; PS

Thyene Simon, 1885	*Thyene calebi* (Kanesharatnam & Benjamin, 2018)	Bilaspur, Korba	PS
	Thyene imperialis (Rossi, 1846)	Bilaspur	PS
18. Scytodidae Blackwall, 1864			
Scytodes Latreille, 1804	*Scytodes alfredi* Gajbe, 2004	Raigarh	Ekka & Kujur, 2015; Kujur & Ekka, 2016a
	Scytodes fusca Walckenaer, 1837	Sarguja, Korba	PS
19. Sparassidae Bertkau, 1872			
Heteropoda Latreille, 1804	*Heteropoda venatoria* (Linnaeus, 1767)	Mungeli	Toppo *et al.*, 2020
Olios Walckenaer, 1837	*Olios milleti* (Pocock, 1901)	Mungeli, Bilaspur, Raigarh	Toppo *et al.*, 2020; PS
20. Tetragnathidae Menge, 1866			
Leucauge White, 1841	*Leucauge celebesiana* (Walckenaer, 1841)	Narayanpur, Raigarh	Gajbe, 2007; Kujur & Ekka, 2016a; PS
	Leucauge decorata (Blackwall, 1864)	Raigarh, Bilaspur, Sarguja	Kujur & Ekka, 2016a, 2016b; Toppo *et al.*, 2020; PS
	Leucauge fastigata (Simon, 1877)	Bilaspur, Raipur, Sarguja, Raigarh	PS
Tetragnatha Latreille, 1804	*Tetragnatha geniculata* Krasch, 1892	Raigarh	Kujur & Ekka, 2016a
	Tetragnatha javana (Thorell, 1890)	Raigarh	Kujur & Ekka, 2012, 2016a; Ekka & Kujur, 2015
	Tetragnatha mandibulata Walckenaer, 1841	Bilaspur, Raipur, Korba	PS
	Tetragnatha vermiformis Emerton, 1884	Raigarh	Kujur & Ekka, 2016a
21. Theridiidae Sundevall, 1833			
Ariamnes Thorell, 1869	*Ariamnes flagellum* (Doleschall, 1857)	Raigarh, Sarguja	PS
Nesticodes Archer, 1950	*Nesticodes rufipes* (Lucas, 1846)	Sarguja, Raigarh	PS
22. Thomisidae Sundevall, 1833			
Amyciaea Simon, 1886	*Amyciaea forticeps* (O. Pickard-Cambridge, 1873)	Bijapur, Bilaspur	Gajbe & Sharma, 1994; Gajbe, 1995; PS
Indoxysticus Benjamin & Jaleel, 2010	*Indoxysticus minutus* (Tikader, 1960)	Bastar, Kanker, Narayanpur, Raigarh, Sarguja	Gajbe & Sharma, 1994; Gajbe, 2005c, 2007; Kujur & Ekka, 2016b

Misumenoides F. O. Pickard-Cambridge, 1900	*Misumenoides gwarighatensis* Gajbe, 2004	Raigarh	Kujur & Ekka, 2012; Ekka & Kujur, 2015
Monaeses Thorell, 1869	*Monaeses jabalpurensis* Gajbe & Rane, 1992	Raigarh	Kujur & Ekka, 2012; Ekka & Kujur, 2015
Oxytate Koch, 1878	*Oxytate elongata* (Tikader, 1980)	Raigarh	Kujur & Ekka, 2012, 2016a; Ekka & Kujur, 2015
Ozyptila Simon, 1864	*Ozyptila amkhasensis* Tikader, 1980	Raigarh	Kujur & Ekka, 2016a
	Ozyptila jabalpurensis Bhandari & Gajbe, 2001	Raigarh	Kujur & Ekka, 2012, 2016a; Ekka & Kujur, 2015
Runcinia Simon, 1875	*Runcinia insecta* (L. Koch, 1875)	Bijapur, Raigarh, Sarguja	Gajbe & Sharma, 1994; Gajbe, 1995, 2007; Kujur & Ekka, 2016a
	Runcinia khandari Gajbe, 2004	Raigarh	Ekka & Kujur, 2015; Kujur & Ekka, 2016a
	Runcinia yogeshi Gajbe & Gajbe, 2001	Raigarh	Ekka & Kujur, 2015; Kujur & Ekka, 2016a
Synema Simon, 1864	*Synema decoratum* Tikader, 1960	Narayanpur, Raigarh	Ekka & Kujur, 2015; Kujur & Ekka, 2016a
	Synema mysorense Tikader, 1980	Raigarh	Ekka & Kujur, 2015; Kujur & Ekka, 2016a
Thomisus Walckenaer, 1805	*Thomisus ashishi* Gajbe, 2005	Kanker	Gajbe, 2005c
	Thomisus bargi Gajbe, 2004	Raigarh	Ekka & Kujur, 2015; Kujur & Ekka, 2016a
	Thomisus danieli Gajbe, 2004	Raigarh	Ekka & Kujur, 2015; Kujur & Ekka, 2016a
	Thomisus elongatus Stoliczka, 1869	Bastar	Gajbe, 2005c, 2007
	Thomisus lobosus Tikader, 1965	Raigarh, Sukma	Gajbe, 2005c, 2007; Kujur & Ekka, 2016
	Thomisus manishae Gajbe, 2005	Raigarh, Rajnandgaon	Gajbe, 2005c; Kujur & Ekka, 2012; Ekka & Kujur, 2015
	Thomisus pateli Gajbe, 2004	Raigarh	Kujur & Ekka, 2012; Ekka & Kujur, 2015
	Thomisus pathaki Gajbe, 2004	Raigarh	Ekka & Kujur, 2015
	Thomisus projectus Tikader, 1960	Bastar, Bijapur, Raigarh	Gajbe & Sharma, 1994; Gajbe, 1995; Kujur & Ekka, 2016a, 2016b

	Thomisus rajani Bhandari & Gajbe, 2001	Raigarh	Kujur & Ekka, 2012, 2016a; Ekka & Kujur, 2015
	Thomisus simoni Gajbe, 2004	Raigarh	Ekka & Kujur, 2015; Kujur & Ekka, 2016a
	Thomisus sundari Gajbe & Gajbe, 2001	Raigarh	Kujur & Ekka, 2016a
	Thomisus viveki Gajbe, 2004	Raigarh	Kujur & Ekka, 2012; Ekka & Kujur, 2015
	Thomisus whitakeri Gajbe, 2004	Raigarh	Ekka & Kujur, 2015
Tmarus Simon, 1875	*Tmarus jabalpurensis* Gajbe & Gajbe, 1999	Raigarh	Kujur & Ekka, 2012, 2016a; Ekka & Kujur, 2015
Xysticus C.L. Koch, 1835	*Xysticus jabalpurensis* Gajbe & Gajbe, 1999	Raigarh	Ekka & Kujur, 2015; Kujur & Ekka, 2016a
	Xysticus joyantius Tikader, 1966	Raigarh, Sarguja	Gajbe, 2007; Ekka & Kujur, 2015; Kujur & Ekka, 2016a
	Xysticus kali Tikader & Biswas, 1974	Raigarh	Ekka & Kujur, 2015; Kujur & Ekka, 2016a
	Xysticus tikaderi Bhandari & Gajbe, 2001	Raigarh	Kujur & Ekka, 2012; Ekka & Kujur, 2015
	Xysticus viveki Gajbe, 2005	Narayanpur	Gajbe, 2005c
23. Uloboridae Thorell, 1869			
Uloborus Latreille, 1806	*Uloborus jabalpurensis* Bhandari & Gajbe, 2001	Raigarh	Ekka & Kujur, 2015
Zosis Walckenaer, 1841	*Zosis geniculata* (Olivier, 1789)	Bastar, Bilaspur, Korba, Raigarh	Kujur & Ekka, 2016a; PS

PS = Present Study, # - New records from Chhattisgarh.

In the current study, a total of 222 species (Literature review and Field visit) from 23 families have been reported from Chhattisgarh (Table 1 and Fig. 1). In the present study, 69 spider species have been documented, out of which 41 were unrecorded before from the state. From the literature a total of 42 species are reported, identified only up to the genus level (Table 2). From the literature, it is found that various common species of spiders still now not been reported from Chhattisgarh. There is no representative of the infraorder Mygalomorphae reported from the state. A number of spider species found in the neighbouring state still have not been reported from Chhattisgarh. The neighbouring state has more spider diversity than Chhattisgarh; i.e., from the state of Maharashtra 785 species from 44 families, from the state of Odisha 264 species from 42 families, from the state of Madhya Pradesh 336 species in 30 families and from the state of Telangana 125 species from 21 families have been reported (Singh, 2021).

The current study documents some new species in the state, due to the lack of manpower and resources the field visit is limited to some parts of the CG. The number of sites selected and species found in the current study may not represent the spider diversity of the state of CG.

Table 2. List of spider taxa (identified up to generic level) of Chhattisgarh.

Family	Species up to genus level only	References
Agelenidae C.L. Koch, 1837)	*Tegenaria* sp.	Kujur & Ekka, 2016a
Araneidae Clerck, 1757	*Araneus* sp.	Mishra & Shrivastava, 2002; Ekka & Kujur, 2015
	Argiope sp.	Kujur & Ekka, 2016a
	Chorizopes sp.	Ekka & Kujur, 2015
	Cyclosa sp.	Ekka & Kujur, 2015
	Cyrtophora sp.	Kujur & Ekka, 2016a
	Eriovixia sp.	Kujur & Ekka, 2016a
	Guizygiella sp.	Ekka & Kujur, 2015
	Larinia sp.	Ekka & Kujur, 2015
	Neoscona sp.	Kujur & Ekka, 2015; Kujur & Ekka, 2016a, 2016b
	Poltys sp.	PS
Deinopidae C.L. Koch, 1850	*Asianopis* sp.	PS
Dictynidae O. Pickard-Cambridge, 1871	*Nigma* sp.	Ekka & Kujur, 2015
Eresidae C.L. Koch, 1845	*Stegodyphus* sp.	Ekka & Kujur, 2015; Kujur & Ekka, 2016a
Gnaphosidae Banks, 1892	*Nodocion* sp.	Kujur & Ekka, 2012; Kujur & Ekka, 2015; Kujur & Ekka, 2016a
	Scopoides sp.	Ekka & Kujur, 2015
	Sergiolus sp.	Ekka & Kujur, 2015; Kujur & Ekka, 2016a
	Sosticus sp.	Kujur & Ekka, 2016a
	Zelotes sp.	Kujur & Ekka, 2016a
Lycosidae Sundevall, 1833	*Hippasa* sp.	Ekka & Kujur, 2015
	Lycosa sp.	Mishra & Shrivastava, 2002
	Pardosa sp.	Mishra & Shrivastava, 2002; Ekka & Kujur, 2015; Kujur & Ekka, 2016a, 2016b
Oxyopidae Thorell, 1869	*Oxyopes* sp.	Ekka & Kujur, 2015; Kujur & Ekka, 2016a, 2016b
	Peucetia sp.	Ekka & Kujur, 2015
Palpimanidae Thorell, 1869	*Palpimanus* Sp.	PS
Philodromidae Thorell, 1869	*Philodromus* sp.	Ekka & Kujur, 2015
	Tibellus sp.	Ekka & Kujur, 2015
Pholcidae C.L. Koch, 1850	*Artema* sp.	Ekka & Kujur, 2015
Salticidae Blackwall, 1841	*Phidippus* sp.	Mishra & Shrivastava, 2002
	Rhene sp.	Kujur & Ekka, 2016a, 2016b
	Zygoballus sp.	Mishra & Shrivastava, 2002
Scytodidae Blackwall, 1864	*Scytodes* sp.	Ekka & Kujur, 2015; Kujur & Ekka, 2016a
Tetragnathidae Menge, 1866	*Leucauge* sp.	Ekka & Kujur, 2015
	Tetragnatha sp.	Mishra & Shrivastava, 2002
Thomisidae Sundevall, 1833	*Misumenoides* sp	Kujur & Ekka, 2016a, 2016b
	Monaeses sp.	Kujur & Ekka, 2016a, 2016b
	Oxytate sp.	Kujur & Ekka, 2016b

	Thomisus sp.	Ekka & Kujur, 2015; Kujur & Ekka, 2016a, 2016b
	Thomisus sp. 1	Kujur & Ekka, 2016a
	Thomisus sp. 2	Kujur & Ekka, 2016a
	Xysticus sp.	Kujur & Ekka, 2016a

PS = Present Study, # - New records from Chhattisgarh.

Conclusion

The study reveals significant gaps in the knowledge of spider fauna in the region, especially compared to neighbouring states like Maharashtra, Odisha, Madhya Pradesh, and Telangana, which have higher documented spider diversity. The absence of representatives from certain infraorders, such as Mygalomorphae, and the underreporting of common species indicate that much of Chhattisgarh's spider biodiversity remains undiscovered.

To address these gaps, future research should focus on comprehensive surveys across various habitats and regions of Chhattisgarh, employing a range of sampling techniques to capture the full extent of spider diversity. Detailed taxonomic studies are also needed to correct past inaccuracies and update the status of species in line with recent revisions. Efforts should be made to explore underrepresented groups, such as Mygalomorphae, to gain a more complete understanding of the state's arachnid fauna. Additionally, building local research capacity through training programs and fostering collaborations with national and international experts can enhance research efforts. Conservation strategies should also be developed based on these findings to protect spider habitats and promote biodiversity. By implementing these recommendations, future studies can provide a more comprehensive understanding of spider diversity in Chhattisgarh, which is essential for biodiversity conservation and ecosystem management.

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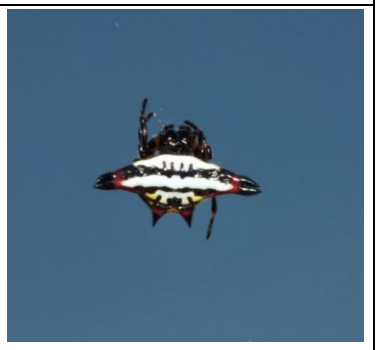
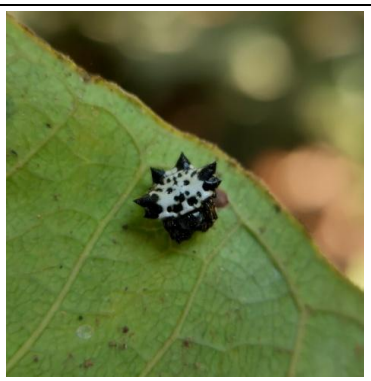
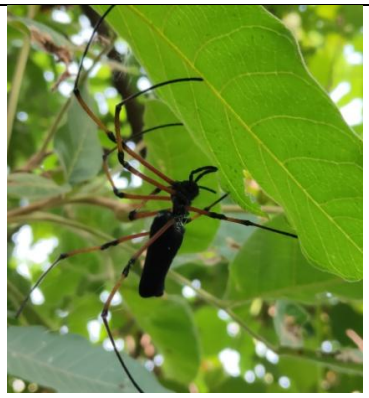
Appendix 1. Photographs of some important spider species found in Chhattisgarh, India.

Family: Araneidae		
Argiope aemula	*Argiope anasuja*	*Argiope pulchella*
Bijoaraneus mitificus	*Cyrtophora citricola*	*Cyrtophora moluccensis*
		
Eriovixia excelsa	*Eriovixia laglaizei*	*Gasteracantha geminata*
		
Gasteracantha kuhli	*Gibbaranea bituberculata*	*Macracantha hasselti*

Neoscona nautica	*Neoscona punctigera*	*Neoscona theisi*
		Family: Corinnidae
		
Nephila pilipes	*Nephila pilipes*	*Corinnomma severum*
Family: Deinopidae	**Family: Eresidae**	**Family: Hersiliidae**
Asianopis sp.	*Stegodyphus sarsinorum*	*Hersilia savignyi*
Family: Oxyopidae		**Family: Palpimanidae**
Oxyopes hindostanicus	*Peucetia viridana*	*Palpimanus* sp.

Family: Pholcidae		Family: Pisauridae
Crossopriza lyoni		*Nilus phipsoni*
	Family: Salticidae	
Carrhotus viduus	*Harmochirus brachiatus*	*Hasarius adansoni*
Hyllus semicupreus	*Myrmaplata plataleoides*	*Phintella vittata*
Plexippus paykulli	*Plexippus petersi*	*Rhene flavigera*

Telamonia dimidiata	*Thyene calebi*	*Thyene imperialis*
Family: Scytodidae		**Family: Sparassidae**
Scytodes fusca		*Olios milleti*
Family: Tetragnathidae		
Leucauge decorata	*Leucauge fastigata*	*Tetragnatha mandibulata*
Family: Theridiidae	**Family: Thomisidae**	**Family: Uloboridae**
Ariamnes flagellum	*Amyciaea forticeps*	*Zosis geniculata*

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New record of *Centromerita concinna* (Thorell, 1875) (Araneae: Linyphiidae) from Türkiye

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Abstract

Centromerita concinna (Thorell, 1875) is recorded for the first time from Türkiye. Digital photographs and a map of distribution record of *C. concinna* are provided. Description and collecting data of this species are also given.

Keywords: Linyphiidae, *Centromerita concinna*, new record, Türkiye.

Introduction

Linyphiidae is the second largest family of spiders, including 4860 species (World Spider Catalog, 2024). There are 156 species in 74 genera from this family recorded in Türkiye (Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024). The new record in this study raises the number of linyphiid species known from Türkiye to 157.

Material and Methods

Two female samples of *Centromerita concinna* (Thorell, 1875) were collected from Rize province, İkizdere district, Anzer Plateau and preserved in 70% ethanol after identification using SZX7 Olympus stereomicroscope. The examined samples were donated to the Niğde Ömer Halisdemir University Arachnology Museum (NÖHUAM).

Identification depended on Roberts (1987) and Wiehle (1956).

Results

Family **Linyphiidae** Blackwall, 1859

Genus ***Centromerita*** Dahl, 1912

Centromerita concinna (Thorell, 1875)

Material examined: Rize province, İkizdere district, Anzer Yaylası (Anzer Plateau), about 40º35'N, 40º31'E, 2210 m, 2♀♀, 13.09.2009, leg. T. Türkeş.

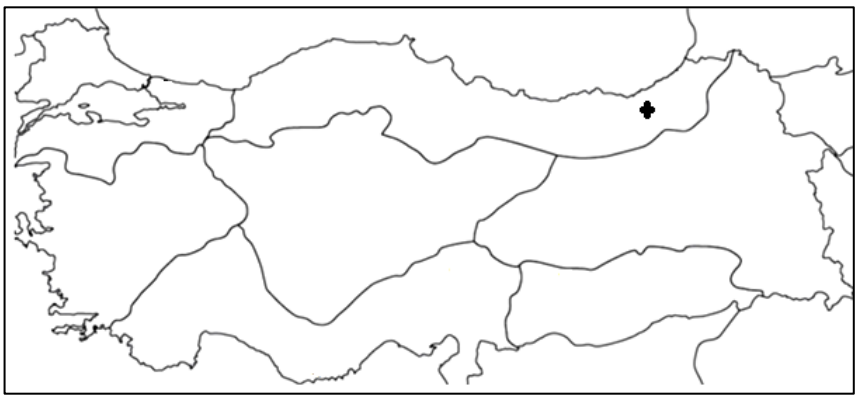

Fig. 1. Locality of *Centromerita concinna* (Thorell, 1875) in Türkiye.

Distribution: Until now, *Centromerita concinna* has been known from Europe, Caucasus (Russia, Georgia) (World Spider Catalog, 2024). Türkiye is a new locality of this species.

Description notes: Female body length: 2.5 mm. Prosoma, chelicerae and legs pale yellow, opisthosoma yellowish grey in colour (Fig. 2). Epigyne as in Fig. (3 A), vulva as in Fig. (3B).

Fig. 2. *Centromerita concinna* (Thorell, 1875) ♀. Habitus, dorsal view.

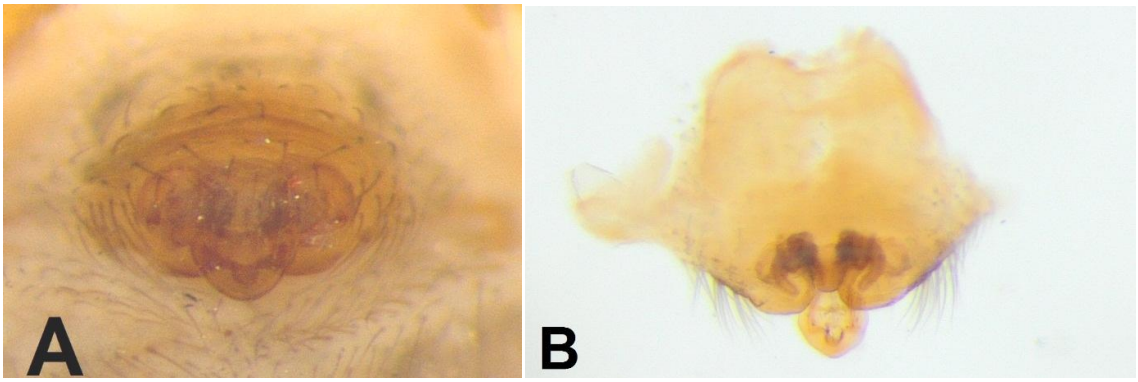

Fig. 3. *Centromerita concinna* (Thorell, 1875) ♀. A. Epigyne, ventral view. B. Vulva, dorsal view.

Centromerita concinna (Thorell, 1875) is the first record of genus *Centromerita* Dahl, 1912 in Türkiye.

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Piratula hurkai (Buchar, 1966) (Araneae: Lycosidae) is a new record for Turkish spider fauna

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Abstract

The lycosid spider species *Piratula hurkai* (Buchar, 1966) is reported for the first time from Türkiye. The habitus and palpal organ of this species were photographed. The locality record where the species was collected is indicated on a map.

Keywords: Lycosidae, *Piratula hurkai*, new record, Türkiye.

Introduction

In family Lycosidae, 2474 species in 134 genera have been identified in the world (World Spider Catalog, 2024). There are 92 species in 15 genera from this family recorded in Türkiye (Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al*., 2024). *Piratula hurkai* (Buchar, 1966) is added in this article to raise the number of lycosid species known from Türkiye to ninety three.

Material and Methods

A male sample of *Piratula hurkai* (Buchar, 1966) was collected from Atrvin province, Borçka district, Cankurtaran gateway. Examined specimen was preserved in 70% ethanol and deposited in the Niğde Ömer Halisdemir University Arachnology Museum (NÖHUAM). For identification: Buchar (1966) and Nadolny & Kovblyuk (2011) were consulted. SZX7 Olympus stereomicroscope was used in identification.

Results

Family **Lycosidae** Sundevall, 1833
Genus ***Piratula*** Roewer, 1960
Piratula hurkai (Buchar, 1966)

Material examined: Atrvin province, Borçka district, Cankurtaran Mevkii (Cankurtaran gateway), about 41º23'28"N, 41º32'19"E, 683 m, 1♂, 03.07.2009, leg. T. Türkeş.

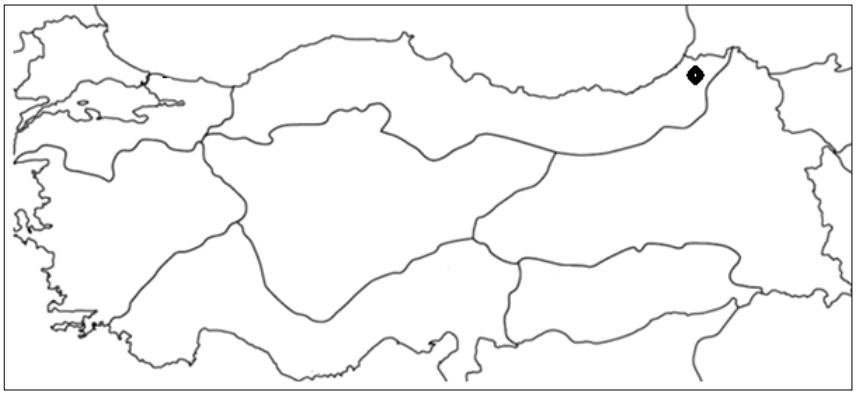

Fig. 1. Locality of *Piratula hurkai* (Buchar, 1966) in Türkiye.

Distribution: *Piratula hurkai* has been known from Caucasus (Russia, Georgia) and Ukraine (World Spider Catalog, 2024). Türkiye is a new locality of this species.

Description notes: Male body length: 4.5 mm. Prosoma, chelicerae, sternum and legs light brown, median band of carapace often with dark forked mark, opisthosoma dark brown (Fig. 2). Male palp ventral and retrolateral views as in Fig. (3A-B).

Fig. 2. *Piratula hurkai* (Buchar, 1966) ♂. Habitus, dorsal view.

Piratula hurkai (Buchar, 1966) is the fourth species of genus *Piratula* Roewer, 1960 recorded in Türkiye after: *Piratula hygrophila* (Thorell, 1872), *Piratula insularis* (Emerton, 1885), and *Piratula latitans* (Blackwall, 1841) (Danışman *et al*., 2024).

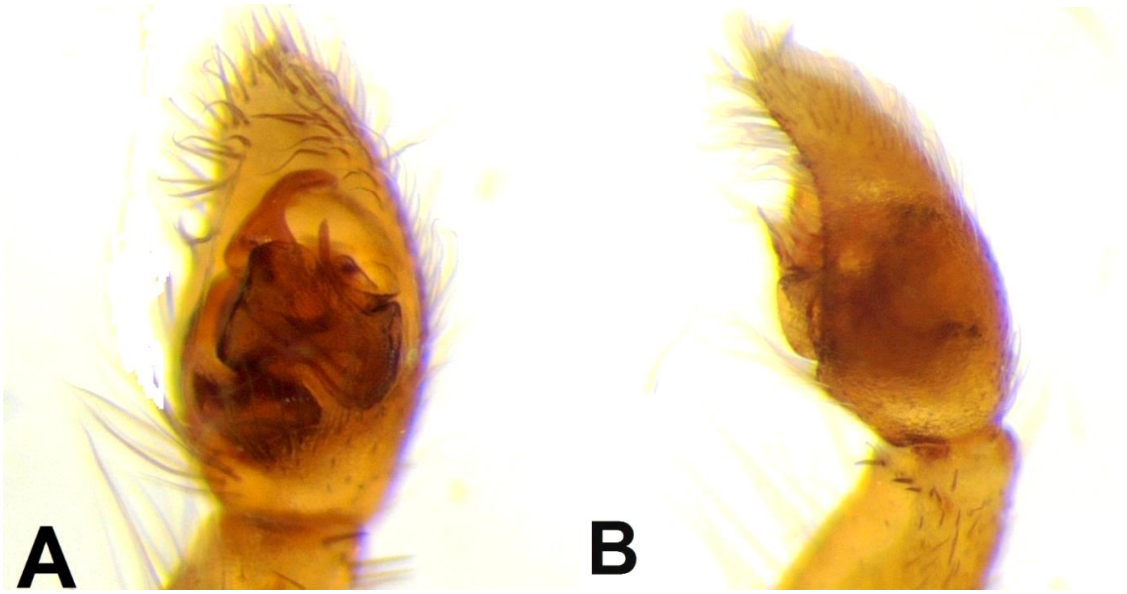

Fig. 3. *Piratula hurkai* (Buchar, 1966) ♂, male palp. A. ventral view. B. retrolateral view.

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Overview of endemic spiders (Arachnida: Araneae) in Türkiye

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Abstract

The endemic spiders of Türkiye comprises 193 species belonging to 25 families, they represent nearly 15% of all spider species of Türkiye. The largest number of endemic species is found in the Dysderidae with 52 species. Also, Macrothelidae and Hersiliidae are 100% endemic. Genus *Harpactea* has the highest endemism with 28 species. The largest number of endemic species is distributed in northern and southern parts of Türkiye. The largest number of endemic species in Türkiye was mainly distributed in caves. Some remarks on conservation of endemic spiders were also added.

Keywords: Endemic, fauna, spider, Türkiye.

Introduction

Türkiye has rich biodiversity and this richness depends on various ecological conditions, various geological formations, and different climates. It is possible to see this richness in spider fauna as well as other living groups in the country. Türkiye is a very large country with a topography that includes quite different microhabitats. Identifying the spider fauna is a big challenge that will take a long time to cover even a small part of it. Thus, describing the spider fauna of Türkiye is very difficult and requires a long time.

The first studies on the spider fauna of Türkiye started in the late 19th century by foreign researchers and the first list of spiders of Türkiye was prepared by Karol (1967) with 302 species belonging to 119 genera and several subspecies. Later, based on Karol's work and with the addition of other literature studies, 520 species belonging to 162 genera from Türkiye were listed by Bayram (2002). More later, Topçu *et al.* (2005) combined the data of Karol (1967) and Bayram (2002) and presented an updated checklist of spiders of Türkiye, revealing the existence of 613 species and 2 subspecies

from Türkiye. Bayram and his colleagues then compiled an online list of spiders in Türkiye. According to this online list, the number of spiders in Türkiye was 690 species belonging to 44 families. Demir & Seyyar (2017) compiled all the checklists and studies and updated this number to 1117 spider species. Since then, many local and foreign researchers have contributed to the spider fauna of Türkiye with their articles, and araneological studies in the country have rapidly continued. According to the online spider checklist, which continues to be updated, 1282 spider species belonging to 371 genera are currently known in Türkiye (Danışman *et al.*, 2024) (Fig. 1).

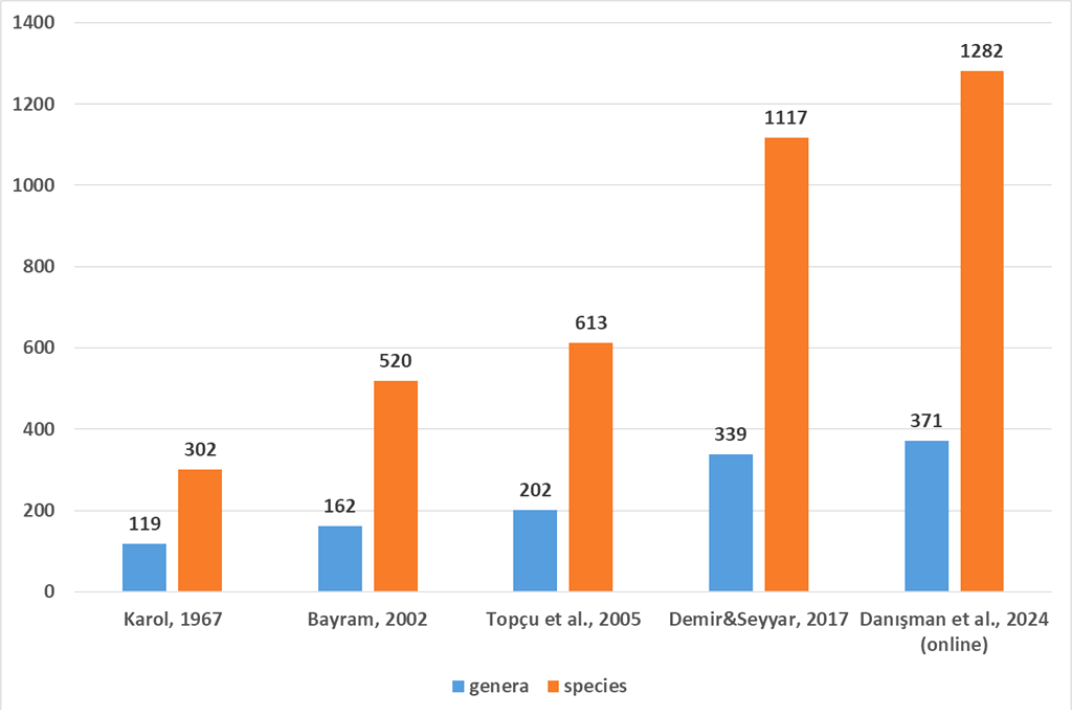

Fig 1. Number of spiders in Türkiye according to published checklists.

All available literature records and new data make it possible to critically examine endemic spiders in Türkiye. The aim of this study is to determine diversity of endemic spiders in Türkiye.

Methods

The list of the Turkish endemic spider fauna is compiled using published records. Species referred to in postgraduate theses and scientific meetings are not formal publications and are consequently not considered herein. Only published papers are used. The general distribution of species was obtained from World Spider Catalog (2024).

Results and Discussion

Türkiye has 57 spider families (Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024). Twenty-five families of them contain endemic spider taxa. According to all available data, 193 species are endemic for Türkiye and they represent nearly 15% of all spider species of the country (Table 1).

Table 1. List of endemic Turkish spider species together with their references.

Endemic species	References
Agelenidae	
Anatextrix monstrabilis Kaya, Zamani, Yağmur & Marusik, 2023	Danışman *et al.*, 2024
Anatextrix spectabilis Kaya, Zamani, Yağmur & Marusik, 2023	Danışman *et al.*, 2024
Coelotes arganoi Brignoli, 1978	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Coelotes coenobita Brignoli, 1978	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Coelotes luculli Brignoli, 1978	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Coelotes phthisicus Brignoli, 1978	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Coelotes rhododendri Brignoli, 1978	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Coelotes sinopensis Danişman, Karanfil & Coşar, 2016	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Coelotes vignai Brignoli, 1978	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Maimuna cariae Brignoli, 1978	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Pireneitega armeniaca (Brignoli, 1978)	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Pireneitega cottarellii (Brignoli, 1978)	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Tegenaria agnolettii Brignoli, 1978	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Tegenaria anhela Brignoli, 1972	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Tegenaria argaeica Nosek, 1905	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Tegenaria averni Brignoli, 1978	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Tegenaria bayrami Kaya, Kunt, Marusik & Uğurtaş, 2010	Danışman *et al.*, 2024
Tegenaria comnena Brignoli, 1978	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Tegenaria cottarellii Brignoli, 1978	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Tegenaria elysii Brignoli, 1978	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Tegenaria forestieroi Brignoli, 1978	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Tegenaria hamid Brignoli, 1978	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Tegenaria karaman Brignoli, 1978	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Tegenaria mamikonian Brignoli, 1978	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Tegenaria melbae Brignoli, 1972	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Tegenaria pasquinii Brignoli, 1978	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Tegenaria tekke Brignoli, 1978	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Tegenaria vanensis Danışman & Karanfil, 2015	Demir &Seyyar, 2017; Danışman *et al.*, 2024
Tegenaria vignai Brignoli, 1978	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Araneidae	
Hypsosinga pygmaea nigriceps (Kulczyński, 1903)	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Cicurinidae	
Cicurina paphlagoniae Brignoli, 1978	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Cybaeidae	
Cryphoeca thaleri Wunderlich, 1995	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Cybaeus brignolii Maurer, 1992	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024

Desidae	
Paracedicus turcicus Gündüz, 2023	Danışman et al., 2024
Dictynidae	
Lathys ankaraensis Özkütük, Marusik, Elverici & Kunt, 2016	Demir & Seyyar, 2017; Danışman *et al*., 2024
Dysderidae	
Dasumia antalyaensis Kunt & Özkütük, 2023	Danışman *et al*., 2024
Dasumia capacii Kunt & Özkütük, 2023	Danışman *et al*., 2024
Dasumia gasparoi Kunt, Özkütük & Elverici, 2011	Demir & Seyyar, 2017; Danışman *et al*., 2024
Dasumia mariandyna Brignoli, 1979	Topçu *et al*., 2005; Demir & Seyyar, 2017; Danışman *et al*., 2024
Dasumia yagmuri Kunt & Özkütük, 2023	Danışman *et al*., 2024
Dysdera akpinarae Varol, 2016	Demir & Seyyar, 2017; Danışman *et al*., 2024
Dysdera anatoliae Deeleman-Reinhold, 1988	Topçu *et al*., 2005; Demir & Seyyar, 2017; Danışman *et al*., 2024
Dysdera argaeica Nosek, 1905	Topçu *et al*., 2005; Demir & Seyyar, 2017; Danışman *et al*., 2024
Dysdera asiatica Nosek, 1905	Topçu *et al*., 2005; Demir & Seyyar, 2017; Danışman *et al*., 2024
Dysdera enguriensis Deeleman-Reinhold, 1988	Topçu *et al*., 2005; Demir & Seyyar, 2017; Danışman *et al*., 2024
Dysdera gruberi Deeleman-Reinhold, 1988	Topçu *et al*., 2005; Demir & Seyyar, 2017; Danışman *et al*., 2024
Dysdera hattusas Deeleman-Reinhold, 1988	Topçu *et al*., 2005; Demir & Seyyar, 2017; Danışman *et al*., 2024
Dysdera mixta Deeleman-Reinhold, 1988	Topçu *et al*., 2005; Demir & Seyyar, 2017; Danışman *et al*., 2024
Dysdera tezcani Varol & Akpınar, 2016	Demir & Seyyar, 2017; Danışman *et al*., 2024
Dysdera topcui Gasparo, 2008	Demir & Seyyar, 2017; Danışman *et al*., 2024
Dysdera turcica Varol, 2016	Demir & Seyyar, 2017; Danışman *et al*., 2024
Dysdera yozgat Deeleman-Reinhold, 1988	Topçu *et al*., 2005; Demir & Seyyar, 2017; Danışman *et al*., 2024
Dysderocrates regina Deeleman-Reinhold, 1988	Topçu *et al*., 2005; Demir & Seyyar, 2017; Danışman *et al*., 2024
Dysderocrates tanatmisi Karakaş Kılıç & Özkütük, 2017	Danışman *et al*., 2024
Harpactea agnolettii Brignoli, 1978	Topçu *et al*., 2005; Demir & Seyyar, 2017; Danışman *et al*., 2024
Harpactea alanyana Özkütük, Elverici, Marusik & Kunt, 2015	Demir & Seyyar, 2017; Danışman *et al*., 2024
Harpactea arnedoi Kunt, Elverici, Özkütük & Yağmur, 2011	Demir & Seyyar, 2017; Danışman *et al*., 2024
Harpactea ballarini Kunt, Özkütük & Elverici, 2013	Demir & Seyyar, 2017; Danışman *et al*., 2024
Harpactea bilecenoglui Kunt & Özkütük, 2023	Danışman *et al*., 2024
Harpactea bilgenur Kunt & Özkütük, 2023	Danışman *et al*., 2024
Harpactea christodeltshevi Bayram, Kunt & Yağmur, 2009	Demir & Seyyar, 2017; Danışman *et al*., 2024
Harpactea colchidis Brignoli, 1978	Topçu *et al*., 2005; Demir & Seyyar, 2017; Danışman *et al*., 2024
Harpactea diraoi Brignoli, 1978	Topçu *et al*., 2005; Demir & Seyyar, 2017; Danışman *et al*., 2024
Harpactea dobati Alicata, 1974	Topçu *et al*., 2005; Demir & Seyyar, 2017; Danışman *et al*., 2024
Harpactea elvericii Kunt & Özkütük, 2023	Danışman *et al*., 2024
Harpactea forceps Varol & Danışman, 2018	Danışman *et al*., 2024
Harpactea galatica Brignoli, 1978	Topçu *et al*., 2005; Demir & Seyyar, 2017; Danışman *et al*., 2024
Harpactea isaurica Brignoli, 1978	Topçu *et al*., 2005; Demir & Seyyar, 2017; Danışman *et al*., 2024
Harpactea kankilicorum Kunt & Özkütük, 2023	Danışman *et al*., 2024
Harpactea karaschkhan Kunt, Özkütük, Elverici, Marusik & Karakaş, 2016	Demir & Seyyar, 2017; Danışman *et al*., 2024
Harpactea kencei Kunt, Elverici, Özkütük & Yağmur, 2011	Demir & Seyyar, 2017; Danışman *et al*., 2024
Harpactea korgei Brignoli, 1979	Topçu *et al*., 2005; Demir & Seyyar, 2017; Danışman *et al*., 2024
Harpactea lazonum Brignoli, 1978	Topçu *et al*., 2005; Demir & Seyyar, 2017; Danışman *et al*., 2024

Harpactea medeae Brignoli, 1978	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Harpactea osellai Brignoli, 1978	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Harpactea pisidica Brignoli, 1978	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Harpactea pugio Varol & Akpınar, 2016	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Harpactea sanctaeinsulae Brignoli, 1978	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Harpactea sbordonii Brignoli, 1978	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Harpactea umay Kunt, Yağmur & Özkütük, 2023	Danışman *et al.*, 2024
Harpactea vignai Brignoli, 1978	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Harpactea yanardagi Kunt & Özkütük, 2023	Danışman *et al.*, 2024
Hygrocrates deelemanus Kunt & Yağmur, 2011	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Hygrocrates kovblyuki Kunt & Marusik, 2013	Danışman *et al.*, 2024
Kut dimensis Kunt, Elverici, Yağmur & Özkütük, 2019	Danışman *et al.*, 2024
Kut izmiricus Kunt, Elverici, Yağmur & Özkütük, 2019	Danışman *et al.*, 2024
Kut troglophilus (Brignoli, 1978)	Danışman *et al.*, 2024
Gnaphosidae	
Berinda cooki Logunov, 2012	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Berinda hakani Chatzaki & Seyyar, 2010	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Berlandina pulchra (Nosek, 1905)	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Drassodes bifidus Kovblyuk & Seyyar, 2009	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Drassodes similis Nosek, 1905	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Drassodes villosus (Thorell, 1856)	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Echemus levyi Kovblyuk & Seyyar, 2009	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Gnaphosa lucifuga minor Nosek, 1905	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Haplodrassus ponomarevi Kovblyuk & Seyyar, 2009	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Nomisia orientalis Dalmas, 1921	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Parasyrisca turkenica Ovtsharenko, Platnick & Marusik, 1995	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Pseudodrassus ricasolii Caporiacco, 1935	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Turkozelotes microb Kovblyuk & Seyyar, 2009	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Zelotes turcicus Seyyar, Demir & Aktaş, 2010	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Zelotes wunderlichi Blick, 2017	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Hersiliidae	
Hersiliola bayrami Danısman, Sancak, Erdek & Coşar, 2012	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Hersiliola turcica Marusik, Kunt & Yağmur, 2010	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Leptonetidae	
Cataleptoneta aesculapii (Brignoli, 1968)	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Cataleptoneta sbordonii (Brignoli, 1968)	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Leptonetela deltshevi (Brignoli, 1979)	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Leptonetela turcica Danışman & Coşar, 2021	Danışman *et al.*, 2024
Linyphiidae	
Centromerus unicolor Roewer, 1959	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Diplocephalus protuberiscus Wunderlich, 2022	Danışman *et al.*, 2024
Gonatium cappadocium Millidge, 1981	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Improphantes turok Tanasevitch, 2011	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Lepthyphantes rossitsae Dimitrov, 2018	Danışman *et al.*, 2024

Mansuphantes korgei (Saaristo & Tanasevitch, 1996)	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Megalepthyphantes globularis Tanasevitch, 2011	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Palliduphantes bayrami Demir, Topçu & Seyyar, 2008	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Pelecopsis topcui (Türkeş, Karabulut, Demir & Seyyar, 2015)	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Saloca elevata Wunderlich, 2011	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Scutpelecopsis media Wunderlich, 2011	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Sintula cristatus Wunderlich, 1995	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Sintula karineae Lecigne, 2021	Danışman *et al.*, 2024
Stemonyphantes abantensis Wunderlich, 1978	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Stemonyphantes montanus Wunderlich, 1978	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Stemonyphantes serratus Tanasevitch, 2011	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Tallusia bicristata Lehtinen & Saaristo, 1972	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Tapinopa gerede Saaristo, 1997 Turkey	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Tenuiphantes wunderlichi (Saaristo & Tanasevitch, 1996)	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Troglohyphantes gladius Wunderlich, 1995	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Troglohyphantes karolianus Topçu, Türkeş & Seyyar, 2008	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Troglohyphantes pisidicus Brignoli, 1971	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Troglohyphantes turcicus Topçu, Türkeş, Seyyar, Demircan & Karabulut, 2014	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Walckenaeria aksoyi Seyyar, Demir & Türkeş, 2008	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Walckenaeria alticeps (Denis, 1952)	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Liocranidae	
Turkocranum bosselaersi Danışman & Coşar, 2022	Danışman *et al.*, 2024
Lycosidae	
Arctosa simoni Guy, 1966	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Pardosa ilgunensis Nosek, 1905	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Macrothelidae	
Macrothele drolshageni Özkütük, Elverici, Yağmur & Kunt, 2019	Danışman *et al.*, 2024
Nemesiidae	
Brachythele zonsteini Özkütük, Yağmur, Elverici, Gücel, Altunsoy & Kunt, 2022	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Raveniola arthuri Kunt & Yağmur, 2010	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Raveniola anadolu Zonstein, Kunt & Yağmur, 2018	Danışman *et al.*, 2024
Raveniola birecikensis Zonstein, Kunt & Yağmur, 2018	Danışman *et al.*, 2024
Raveniola micropa (Ausserer, 1871)	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Raveniola nana Zonstein, Kunt & Yağmur, 2018	Danışman *et al.*, 2024
Raveniola sinani Zonstein, Kunt & Yağmur, 2018	Danışman *et al.*, 2024
Raveniola turcica Zonstein, Kunt & Yağmur, 2018	Danışman *et al.*, 2024
Nesticidae	
Kryptonesticus dimensis (López-Pancorbo, Kunt & Ribera, 2013)	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Typhlonesticus gocmeni Ribera, Elverici, Kunt & Özkütük, 2014	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Oonopidae	
Orchestina topcui Danışman & Coşar, 2012	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Silhouettella osmaniye Wunderlich, 2011	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Philodromidae	
Philodromus bonneti Karol, 1968	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Philodromus bucaensis (Logunov & Kunt, 2010)	Demir & Seyyar, 2017; Danışman *et al.*, 2024

Philodromus krausi Muster & Thaler, 2004	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Thanatus okayi Karol, 1966	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Pholcidae	
Hoplopholcus asiaeminoris Brignoli, 1978	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Hoplopholcus patrizii (Roewer, 1962)	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Pholcus spasskyi Brignoli, 1978	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Pholcus turcicus Wunderlich, 1980	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Salticidae	
Aelurillus alboclypeus Azarkina & Komnenov, 2015	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Euophrys fucata (Simon, 1868)	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Habrocestum nigristernum Dalmas, 1920	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Heliophanus feltoni Logunov, 2009	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Heliophanus konradthaleri Logunov, 2009	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Pseudomogrus zaraensis (Logunov, 2009)	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Salticus ressli Logunov, 2015	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Theraphosidae	
Chaetopelma turkesi Topçu & Demircan, 2014	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Theridiidae	
Robertus brachati Wunderlich, 2011	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Thomisidae	
Bassaniodes anatolicus (Demir, Aktaş & Topçu, 2008)	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Heriaeus pilosus Nosek, 1905	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Ozyptila ankarensis Karol, 1966	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Ozyptila clavidorsum Roewer, 1959	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Ozyptila kahramanmarasensis Coşar & Danışman, 2021	Danışman *et al.*, 2024
Ozyptila spirembola Wunderlich, 1995	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Psammitis demirsoyi (Demir, Topçu & Türkeş, 2006)	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Synema anatolicum Demir, Aktaş & Topçu, 2009	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Xysticus pseudolanio Wunderlich, 1995	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Xysticus tenuiapicalis Demir, 2012	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Zodariidae	
Zodarion bigaense Bosmans, Özkütük, Varli & Kunt, 2014	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Zodarion bozdagense Coşar, 2021	Danışman *et al.*, 2024
Zodarion crewsae Coşar, Danışman & Kunt, 2022	Danışman *et al.*, 2024
Zodarion danismani Coşar, 2021	Danışman *et al.*, 2024
Zodarion deltshevi Bosmans, 2009	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Zodarion gaziantepense Danışman & Coşar, 2021	Danışman *et al.*, 2024
Zodarion izmirense Danışman & Coşar, 2020	Danışman *et al.*, 2024
Zodarion korgei Wunderlich, 1980	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024
Zodarion kunti Coşar, Danışman & Yağmur, 2021	Danışman *et al.*, 2024
Zodarion ozkutuki Coşar & Danışman, 2021	Danışman *et al.*, 2024
Zodarion robertbosmans Wunderlich, 2017	Danışman *et al.*, 2024
Zodarion siirtense Coşar, 2021	Danışman *et al.*, 2024
Zodarion turkesi Coşar & Danışman, 2021	Danışman *et al.*, 2024
Zodarion van Bosmans, 2009	Demir & Seyyar, 2017; Danışman *et al.*, 2024

Zodarion varoli Akpınar, 2016	Demir & Seyyar, 2017; Danışman *et al.*, 2024
Zodarion yagmuri Coşar & Danışman, 2021	Danışman *et al.*, 2024
Zoropsidae	
Zoropsis beccarii Caporiacco, 1935	Topçu *et al.*, 2005; Demir & Seyyar, 2017; Danışman *et al.*, 2024

According to Table (1), the largest number of endemic species is found in the Dysderidae, with 52 species, followed by Agelenidae (29) and Linyphiidae (25) (Fig. 2). Macrothelidae and Hersiliidae are 100% endemic in Türkiye (Fig. 3).

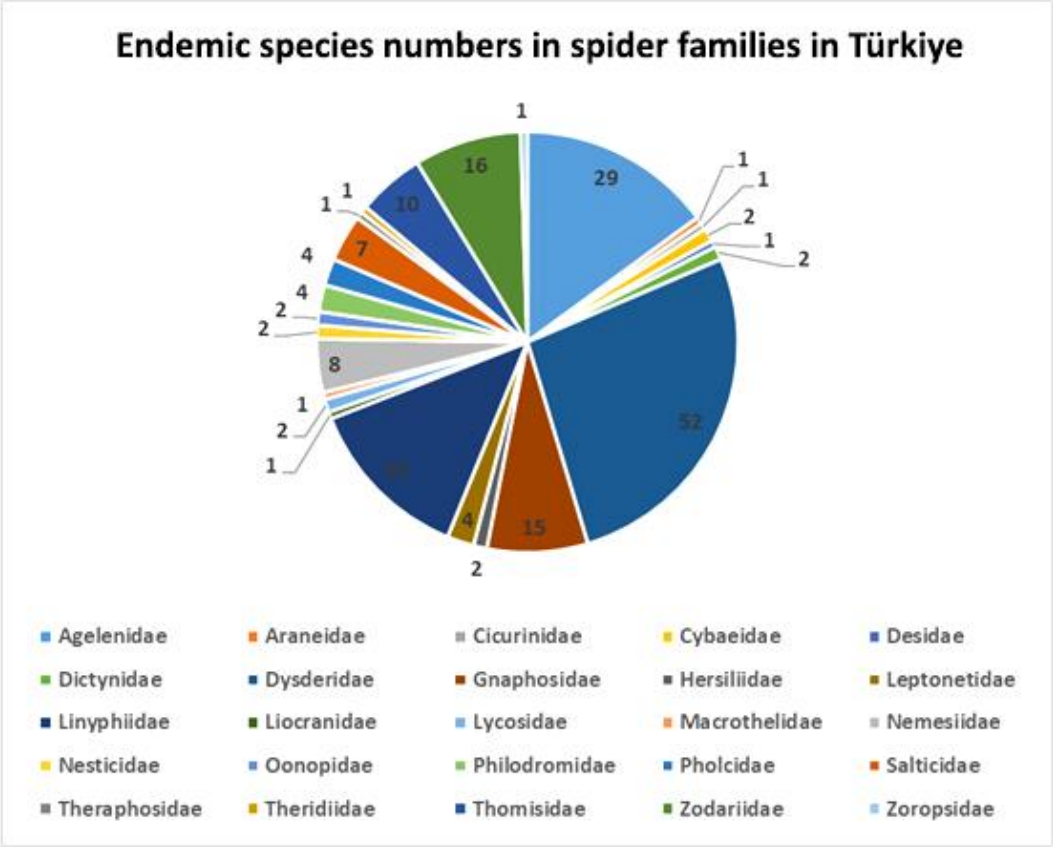

Fig 2. The number of endemic species in spider families in Türkiye.

The spider fauna of Türkiye has an endemism rate of about 15%. According to Deltshev (2000), the largest endemic species have usually found in the restricted area such as islands, caves, high altitude zone, and woodland. Most of the endemic species in Türkiye live in caves, especially in the southern part of Türkiye (Topçu *et al.*, 2006; Seyyar *et al.*, 2017). Türkiye has a large number of caves due to their different geological structures and formations. According to the data of Directorate of Mineral Research and Exploration Institute (M.T.A.), only 1250 of the 40.000 caves in Türkiye have been explored. The number of caves examined araneologically in Türkiye is quite limited. However, spiders living in caves are sensitive creatures like other cave creatures. Anthropological effects such as the opening of caves to tourism and pollution of groundwater adversely affect cave spiders like other cave creatures. Therefore, it is very important to develop various conservation strategies for cave spiders and to protect these natural habitats.

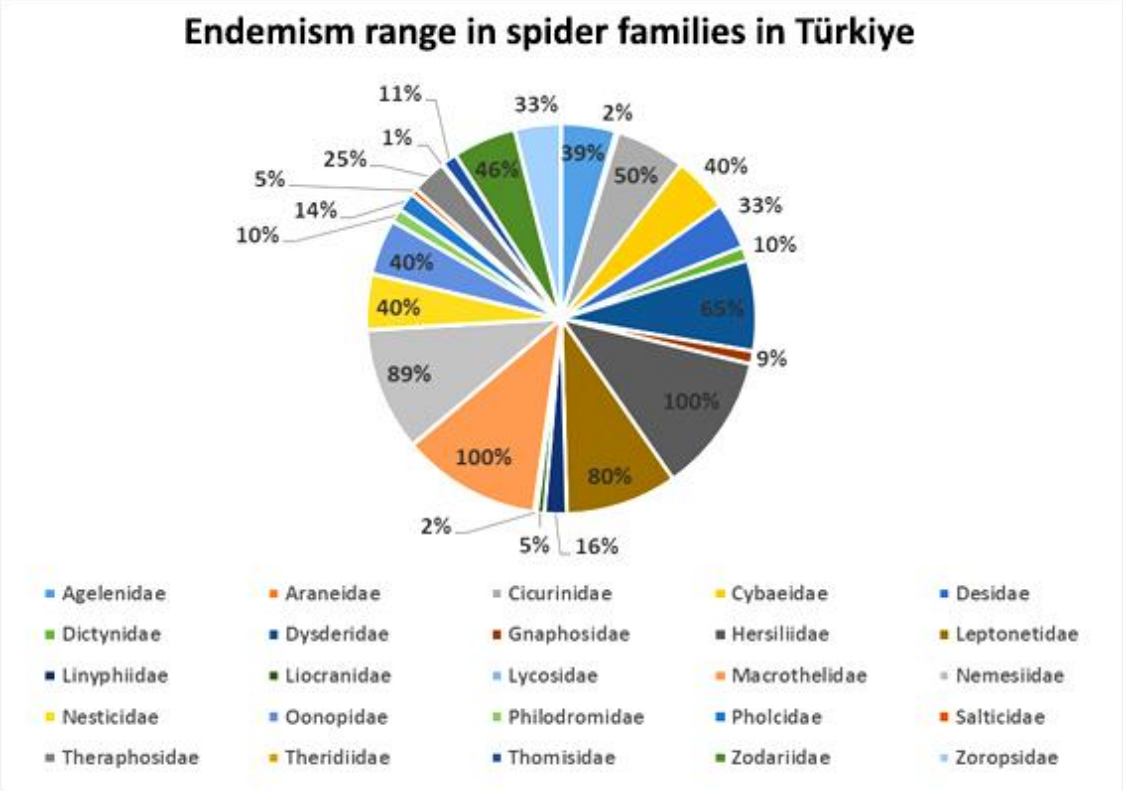

Fig. 3. The ratios of endemic species number to the total number of species in the same families in Türkiye.

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The genera: *Bassaniodes*, *Psammitis*, *Spiracme*, and *Xysticus* (Araneae: Thomisidae) in Türkiye

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Abstract

A list of 49 species of the thomisid spider genera *Bassaniodes*, *Psammitis*, *Spiracme*, and *Xysticus* known from Türkiye is reviewed based on both published records available to the author and his original data. The main aim of this work is to clarify current status of the members of these genera in Türkiye. Provinces and general distribution of all species are also given.

Keywords: Araneae, Thomisidae, *Bassaniodes*, *Psammitis*, *Spiracme*, *Xysticus*, Türkiye.

Introduction

Crab spiders (Araneae, Thomisidae) are rather common in Türkiye. *Bassaniodes* Pocock, 1903, *Psammitis* Menge, 1876, *Spiracme* Menge, 1876, and *Xysticus* C.L. Koch, 1835 are genera of the family Thomisidae, with 375 species and subspecies being listed in the latest version (25.5) of the world spider catalogue (World Spider Catalog, 2024). Türkiye has significant ecological properties. It may be the origin country of many spider taxa and it may also be a *refugium* (an area where conditions have enabled a species or a community of species to survive after extinction in surrounding areas) for living creatures affected by geological and climatic changes more than many countries in the World (Demir, 2008). Because of this, Türkiye has been focusing by Turkish and foreign scientists for a long period. They made very important contributions to the Turkish thomisid fauna. So far, 49 species of these genera have been recorded from Türkiye, most of which are known from a single or just a few localities (Topçu *et al.*, 2005; Demir, 2008, 2012; Demir *et al.*, 2010a,b,c; Demir & Seyyar, 2017; Danışman *et al.*, 2024).

Besides, the number of studies are not enough to cover the whole fauna. It can be expected that Turkish spider numbers can increase if they are studied in detail.

In the current study, the occurrence of the genera *Bassaniodes*, *Psammitis*, *Spiracme*, and *Xysticus* in Türkiye is reviewed.

Material and Methods

Most of the studied specimens were collected in central and southern part of Türkiye by pitfall trapping and hand collecting and deposited in the Arachnology Museum of the Niğde University, Niğde, Türkiye (NUAM).

World Distribution is according to World Spider Catalog (2024).

Results

Family **Thomisidae** Sundevall, 1833

Genus ***Bassaniodes*** Pocock, 1903

Bassaniodes anatolicus (Demir, Aktaş & Topçu, 2008)
Records in Türkiye: Kayseri (Demir *et al.*, 2008b).
World Distribution: Türkiye.

Bassaniodes bufo (Dufour, 1820)
Records in Türkiye: İstanbul, İzmir (Demir, 2008).
World Distribution: Mediterranean.

Bassaniodes caperatus (Simon, 1875)
Material examined: 2♂♂ (NUAM), **Antalya province,** Kaş, Demre, Çevreli village; 2♂♂ (NUAM), Kalkan-Elmalı, 13.06.2007; 1♀ (NUAM), Akseki, 27.06.2007; 1♂ (NUAM), **Muğla province,** Fethiye, Gölbent, 13.06.2007; 2♀♀ (NUAM), **Niğde province,** Meydan plateau, 28.06.2007.
Records in Türkiye: Osmaniye (Demir *et al.*, 2009), Antalya, Muğla, Niğde (present study).
World Distribution: Mediterranean, Türkiye, Ukraine, Russia (Europe, Caucasus).

Bassaniodes cribratus (Simon, 1885)
Records in Türkiye: Ankara (Demir, 2008).
World Distribution: Mediterranean, Russia (Europe), Türkiye, Caucasus, Iran, China, Korea.

Bassaniodes ferus (O. Pickard-Cambridge, 1876)
Records in Türkiye: Muğla (Demir, 2008).
World Distribution: Cyprus, Egypt, Israel.

Bassaniodes graecus (C.L. Koch, 1837)
Material examined: 1♀ (NUAM), **İçel province**, Tarsus, Belemedik village, (37°20´N, 34°54´E), 706 m, 19.04.2007.
Records in Türkiye: Ankara, Bursa, İstanbul (Demir, 2008), İçel (present study).
World Distribution: Italy, Balkans, Greece, Ukraine, Russia (Europe), Türkiye, Israel, Iraq.

Bassaniodes lalandei (Audouin, 1825)
Records in Türkiye: Ankara, Kayseri, Konya, Muğla, Niğde (Demir, 2008).
World Distribution: Mediterranean, Azerbaijan.

Bassaniodes loeffleri (Roewer, 1955)
Records in Türkiye: Türkiye (Its exact location in Turkey is unknown) (Roewer, 1955)
World Distribution: Greece, Türkiye, Caucasus, Iraq, Iran, Kazakhstan, Central Asia.

Bassaniodes pseudorectilineus (Wunderlich, 1995)
Material examined: 2♀♀ (NUAM), **İçel province**, Gözne plateau, 29.03.2008; 1♀ (NUAM), Taşkent, Başyayla, 27.06.2007; 4♀♀ (NUAM), **Kayseri province**, Yahyalı, Dikme village, 26.05.2007; 1♀ (NUAM), Yahyalı, near the Kapuzbaşı waterfall, 26.05.2007; 2♀♀ (NUAM), **Konya province**, Seydişehir, near the Tınaztepe caves, 21.05.2006; 3♂♂1♀ (NUAM), Seydişehir, 23.09.2006; 1♀ (NUAM), Gölhisar, Çameli, 12.06.2007; 1♀ (NUAM), **Muğla province**, Göğü, 13.06.2007; 1♀ (NUAM), **Niğde province**, Alihoca village, 19.04.2007.
Records in Türkiye: Adana, Antalya, Gaziantep, İçel, Kayseri, Nevşehir, Niğde, Osmaniye, Şanlıurfa (Demir, *et al*., 2008a), Konya, Muğla (present study).
World Distribution: Greece, Cyprus, Türkiye, Georgia (Wunderlich, 1995; Demir *et al.*, 2008a; World Spider Catalog, 2024).

Bassaniodes rectilineus (O. Pickard-Cambridge, 1872)
Records in Türkiye: Ankara (Demir, 2008).
World Distribution: Syria, Lebanon, Israel, Iran.

Bassaniodes robustus (Hahn, 1832)
Records in Türkiye: Gaziantep, İçel, Kırıkkale, Konya, Niğde, Van (Demir, 2008).
World Distribution: Europe to Central Asia.
Remarks: Although this species was recorded from Türkiye several times, its occurrence should be confirmed. It is highly probable that all previous records may refer to *B. caperatus* (Simon, 1875).

Bassaniodes tenebrosus (Šilhavý, 1944)
Records in Türkiye: Sinop (Danışman *et al.*, 2024)
World Distribution: Slovenia to Türkiye.

Bassaniodes tristrami (O. Pickard-Cambridge, 1872)
Material examined: 5♀♀ (NUAM), **Antalya province**, Elmalı-Fethiye, 12.06.2007; 5♀♀ (NUAM), **Burdur province**, Ağlasun, Sagossos, 11.06.2007; 2♂♂3♀♀ (NUAM), **Isparta province**, Ağlasun, Köroğlu, 11.06.2007; 2♀♀ (NUAM), **Karaman province**, Taşkale, 25.06.2007; 1♀ (NUAM), Sertavul pass, 29.03.2008; 2♀♀ (NUAM), Taşkent, Başyayla, 27.06.2007; 1♀ (NUAM), **Kayseri province**, Yahyalı, near the Kapuzbaşı waterfall, 26.05.2007; 3♂♂3♀♀ (NUAM), Yahyalı, Dikmen village, 26.05.2007.
Records in Türkiye: Hatay, Kayseri, Konya, Niğde (Demir, 2008), Antalya, Burdur, Isparta, Karaman (present study).
World Distribution: Greece, Türkiye, Caucasus, Russia (Europe) to Central Asia, Middle East, India, China.

Genus ***Psammitis*** Menge, 1876

Psammitis abramovi (Marusik & Logunov, 1995)
Records in Türkiye: Adana, Kahramanmaraş (Demir *et al.*, 2010b).
World Distribution: Türkiye, Iran, Tajikistan.

Psammitis demirsoyi (Demir, Topçu & Türkeş, 2006)
Records in Türkiye: Niğde (Demir *et al.*, 2006).
World Distribution: Türkiye.

Psammitis marmorata (Thorell, 1875)
Material examined: 2♂♂1♀ (NUAM), **Niğde province**, Ulukışla, Kolsuz pass, 1400 m, 14.05.1996.
Records in Türkiye: Ankara (Demir, 2008), Niğde (present study).
World Distribution: Central Europe, Balkans, Greece, Ukraine, Russia (Europe), Türkiye, Caucasus, Kazakhstan.

Psammitis ninnii fusciventris (Crome, 1965)
Material examined: 1♂1♀ (NUAM), **Kayseri province**, Erciyes mountain, 28.06.2007; 1♂ (NUAM), **Niğde province**, Alihoca village, 28.06.2007; 2♂♂4♀♀ (NUAM), Gümüş village, 28.06.2007.
Records in Türkiye: Çankırı, İçel, Kayseri, Konya, Sivas, Van (Demir, 2008), Niğde (present study).
World Distribution: Eastern Europe to Mongolia.

Psammitis sabulosa (Hahn, 1832)
Records in Türkiye: İçel, İstanbul, Niğde, Van (Demir, 2008).
World Distribution: Europe, North Africa, Türkiye, Caucasus, Russia (Europe to Middle Siberia), Afghanistan.

Genus ***Spiracme*** Menge, 1876

Spiracme striatipes (L. Koch, 1870)
Material examined: 2♂♂1♀ (NUAM), **Konya province**, Karapınar, Acıgöl, 23.09.2006.
Records in Türkiye: Ankara, Bursa, İçel (Demir, 2008), Konya (present study).
World Distribution: Europe, Türkiye, Caucasus, Russia (Europe) to Central Asia, Iran, China.

Genus ***Xysticus*** C.L. Koch, 1835

Xysticus abditus Logunov, 2006
Material examined: 1♂ (NUAM), **Hatay province,** Dörtyol, Yahyalı plateau, (36°49´N, 36°17´E), 988 m, 04.05.2007.
Records in Türkiye: Niğde (Demir, 2008), Hatay (present study).
World Distribution: Bulgaria, Türkiye (Logunov, 2006).

Xysticus acerbus Thorell, 1872
Material examined: 1♀ (NUAM), **İçel province,** Tarsus, Gülek town, (37°12´N, 34°48´E), 815 m, 07.08.2002.
Records in Türkiye: Gaziantep, İstanbul (Demir, 2008), İçel (present study).
World Distribution: Europe to Central Asia, Russia (Europe to Far East).

Xysticus audax (Schrank, 1803)
Records in Türkiye: Adana, Hatay, İstanbul, Osmaniye (Demir, 2008).
World Distribution: Europe, Türkiye, Caucasus, Russia (Europe to Far East), Kazakhstan, Iran, China, Korea, Japan.

Xysticus bacurianensis Mcheidze, 1971
Records in Türkiye: Trabzon (Demir, 2008).
World Distribution: Azerbaijan, Georgia, Russia, Türkiye (Logunov & Demir, 2006; Mcheidze, 1971).

Xysticus bifasciatus C.L. Koch, 1837
Records in Türkiye: Aydın, İzmir, Kırıkkale, Konya, Manisa, Niğde (Demir, 2008).
World Distribution: Europe, Türkiye, Caucasus, Russia (Europe to South Siberia), Kazakhstan, Central Asia, China.

Xysticus cor Canestrini, 1873
Material examined: 3♂♂6♀♀ (NUAM), **Osmaniye province,** Boğaz plateau, Yarpuz village, (37°03´N, 36°25´E), 903 m, 01.05.2007; 1♂ (NUAM), Zorkun, Olukbaşı plateau, (36°58´N, 36°19´E), 1520 m, 23.05.2007.
Records in Türkiye: Adana, Hatay, İçel, Kahramanmaraş, Osmaniye (Demir *et al.*, 2010a).
World Distribution: Azores, Southern Europe, Türkiye, Iran.

Xysticus cristatus (Clerck, 1757)
Records in Türkiye: Aydın, Denizli, İçel, İzmir, Kırıkkale, Konya, Manisa, Niğde, Trabzon, Van (Demir, 2008).
World Distribution: Europe, Türkiye, Caucasus, Russia (Europe to South Siberia), Kazakhstan, Iran, Central Asia, Nepal, China, Korea, Japan. Introduced to Canada, USA.

Xysticus edax (O. Pickard-Cambridge, 1872)
Material examined: 1♂ (NUAM), **Kayseri province,** Sultansazlığı, 25.04.2008; 3♂♂ 4♀♀ (NUAM), **Osmaniye province,** Kadirli, Karatepe, (37°15´N, 36°13´E), 127 m, 27.03.2008.
Records in Türkiye: Hatay, Kahramanmaraş, Kilis, Osmaniye (Demir *et al.*, 2009), Kayseri (present study).
World Distribution: Türkiye, Israel, Iraq, Iran.

Xysticus erraticus (Blackwall, 1834)
Records in Türkiye: Van (Demir, 2008).
World Distribution: Europe, Turkey, Caucasus (Russia).

Xysticus ferrugineus Menge, 1876
Material examined: 2♀♀ (M), **Niğde province,** (37°29′N, 34°42′E), May 2002.
Records in Türkiye: Niğde (Topçu & Demir, 2004).
World Distribution: Europe, Türkiye, China.
Remark: The record of *X. ferrugineus* from the Central Anatolian part of Türkiye (Topçu & Demir, 2004) actually belongs to *X. thessalicus* (NUAM's material re-examined).

Xysticus gallicus Simon, 1875
Material examined: 2♀♀ (NUAM), **Kayseri province,** Erciyes mountain, 28.06.2007, 2♂♂2♀♀ (NUAM), Yılanlı mountain, 2300 m, 12.06.2006; 1♀ (NUAM), **Niğde province,** Meydan plateau, 28.06.2007.
Records in Türkiye: Kayseri (Demir, 2008), Niğde (present study).
World Distribution: Europe, Türkiye, Caucasus, Iran.

Xysticus kaznakovi Utochkin, 1968
Material examined: 1♂1♀ (NUAM), **Niğde province**, Ulukışla, Kolsuz pass, 1700 m, 14.05.1996; 1♂2♀♀ (NUAM), Murtaza dam 1 (38°08'N, 34°34'E), 1895 m.
Records in Türkiye: Kahramanmaraş, Osmaniye (Demir *et al.*, 2009), Niğde (present study).
World Distribution: North Macedonia, Bulgaria, Greece, Türkiye, Caucasus (Russia, Azerbaijan), Iran, Turkmenistan, Tajikistan.

Xysticus kochi Thorell, 1872
Material examined: 1♂1♀ (NUAM), **Niğde province**, Ulukışla, Kolsuz pass, 1700 m, 14.05.1996.
Records in Türkiye: Adana, Ankara, Bolu, Bursa, Çankırı, Denizli, Isparta, İçel, İstanbul, Kayseri, Kırıkkale, Konya, Nevşehir, Niğde, Sakarya, Sinop, Van, Yozgat, Zonguldak (Demir, 2008).
World Distribution: Europe, Mediterranean to Central Asia.

Xysticus laetus Thorell, 1875
Material examined: 1♂ (NUAM), **İçel province**, Anamur, Bozdoğan village, (36°04´N, 32°53´E), 14 m, 22.04.2008; 1♂2♀♀ (NUAM), **Niğde province**, Ulukışla, Kolsuz pass, 1700 m, 14.05.1996.
Records in Türkiye: Antalya, Bolu, Bursa, Çankırı, İçel, Kırıkkale, Konya, Nevşehir, Niğde, Yozgat (Demir, 2008).
World Distribution: Italy to Caucasus, Iran.

Xysticus lanio C.L. Koch, 1835
Material examined: 1♂ (NUAM), **Hatay province**, Dörtyol, Yahyalı plateau, (36°49´N, 36°17´E), 988 m, 04.05.2007.
Records in Türkiye: Hatay, İstanbul, İçel, Niğde (Demir, 2008).
World Distribution: Europe, Türkiye, Caucasus, Russia (Europe to Middle and South Siberia), Turkmenistan.

Xysticus lineatus (Westring, 1851)
Material examined: 2♀♀ (NUAM), **İçel province**, Belemedik village, (37°20′N, 34°54′E), May 2003.
Records in Türkiye: İçel (Topçu & Demir, 2004).
World Distribution: Europe, Caucasus, Russia (Europe to Central Asia), Kazakhstan, China.
Remark: The record of *X. lineatus* from the Eastern Mediderranean part of Türkiye (Topçu & Demir, 2004) actually belongs to *X. kochi* (NUAM's material re-examined).

Xysticus luctator L. Koch, 1870
Records in Türkiye: Niğde (Demir, 2008).
World Distribution: Europe, Caucasus, Russia (Europe to South Siberia), Kazakhstan.

Xysticus luctuosus (Blackwall, 1836)
Material examined: 1♂ (NUAM), **Antalya province**, Kaş, Demre, Çevreli village.
Records in Türkiye: Gaziantep, Konya, Van (Demir, 2008), Antalya (present study).
World Distribution: North America, Europe, Türkiye, Caucasus, Russia (Europe to Far East), Kazakhstan, Iran, Central Asia.

Xysticus macedonicus Šilhavý, 1944
Records in Türkiye: Gaziantep (Demir, 2008).
World Distribution: Germany, Switzerland, Austria, Italy, Kosovo, Albania, North Macedonia, Greece, Türkiye.

Xysticus marusiki Ono & Martens, 2005
Material examined: 1♂ (NUAM), **Kayseri province**, Yeşilhisar, Soğanlı village, 23.06.2001; 3♂♂ (NUAM), **Niğde province**, Uluağaç pond, 16.06.2001.
Records in Türkiye: Kayseri, Niğde (Demir *et al.*, 2008c).
World Distribution: Iran, Türkiye.

Xysticus metinaktasi Demir, Seyyar & Türker, 2017
Records in Türkiye: Afyonkarahisar, Uşak (Demir *et al.*, 2017).
World Distribution: Türkiye (Demir *et al.*, 2017).

Xysticus nubilus Simon, 1875
Records in Türkiye: İzmir (Demir, 2008).
World Distribution: Macaronesia, Mediterranean, Georgia.

Xysticus pseudolanio Wunderlich, 1995
Material examined: 1♂ (NUAM), **Kayseri province**, Sultan Sazlığı, Çayağzı village, 27.05.2005.
Records in Türkiye: Artvin, Bolu (Wunderlich, 1995), Kayseri (present study).
World Distribution: Bulgaria, Georgia, Türkiye.
Remarks. *X. pseudolanio* was described by Wunderlich (1995) on the basis of only male sex from Bolu and Artvin provinces of Türkiye; with no further records having been reported so far. *X. pseudolanio* has occured in Black Sea Region of Türkiye until now, We record it from Central Anatolian Region for the first time.

Xysticus pseudoluctuosus Marusik & Logunov, 1995
Records in Türkiye: İçel (Demir *et al.*, 2010b).
World Distribution: Cyprus, Tajikistan, Türkiye.

Xysticus tenuiapicalis Demir, 2012
Records in Türkiye: Aksaray, Ankara, Nevşehir (Demir, 2012).
World Distribution: Türkiye (Demir, 2012).

Xysticus thessalicoides Wunderlich, 1995
Records in Türkiye: Antalya, Bolu, Kastamonu, Trabzon (Demir, 2008).
World Distribution: Greece (including Crete), Türkiye (Wunderlich, 1995).

Xysticus thessalicus Simon, 1916
Material examined: 2♀♀ (NUAM), **İçel provinve**, Mut-Gençeli, 29.03.2008; 1♀ (NUAM), Tefenni, Sülekler village, 11.06.2007; 1♀ (NUAM), **Kayseri province**, Yahyalı, Dikmen village, 26.05.2007; 1♂ (NUAM), Talas, 18.05.2007; 2♂♂4♀♀ (NUAM), **Konya province**, Seydişehir, 21.05.2006; 1♀ (NUAM), **Niğde province**, Gümüş village, 28.06.2007.
Records in Türkiye: Ankara, İçel, Konya, Manisa, Yozgat (Demir, 2008), Kayseri, Niğde (present study).
World Distribution: Albania, Bulgaria, Croatia, Greece, Israel, Türkiye.

Xysticus ulmi (Hahn, 1831)
Records in Türkiye: Gaziantep, İçel, Kırıkkale, Konya, Van (Demir, 2008).
World Distribution: Europe, Türkiye, Caucasus, Russia (Europe to Middle and South Siberia), Central Asia, China.

Xysticus viduus Kulczyński, 1898
Material examined: 1♀ (NUAM), **Niğde province**, Meydan plateau, (37°35′N, 34°33′E), 2200 m, June 2003.
Records in Türkiye: Niğde (Topçu & Demir, 2004).
World Distribution: Europe, Türkiye, Caucasus, Russia (Europe to Middle Siberia), Kazakhstan.

Remark: The records of *X. viduus* by Topçu & Demir (2004) from the Central Anatolian part of Türkiye have made on the basis of immature specimens (NUAM's material re-examined) and therefore are neglected here.

Xysticus xerodermus Strand, 1913
Material examined: 1♀ (NUAM), **İçel province**, Çamalan, Kaburgediği village (37°10´N, 34°48´E), 622 m, 16.07.2002.
Records in Türkiye: Konya, Yozgat (Logunov & Demir, 2006), İçel (present study).
World Distribution: Iran, Israel, Türkiye.

Discussion

Türkiye is a bridge between Asia and Europe. Its geographical location is very important in Palaearctic region. Türkiye consists of two general parts as Trace and Anatolia. The European section of Türkiye is eastern Thrace. It forms the borders of Türkiye with Greece and Bulgaria. The Asian part of the country, Anatolia, consists of a high central plateau with narrow coastal plains. Türkiye has a great variability in topography and climate. The fact that Anatolia is surrounded from three sides by sea, its situation in the temperate climatic zone, its geological and geomorphic structure, and topography are main contributing factors affecting diversity of species in terrestrial ecosystems (Demir, 2008). Although the genera *Bassaniodes*, *Psammitis*, *Spiracme*, and *Xysticus* of Türkiye are well studied, there is always a need to present updated information because of the changes in the taxonomic nomenclature and many surveys resulting new records and localities.

This review is concerned with the Türkiye species of *Bassaniodes*, *Psammitis*, *Spiracme*, and *Xysticus* crab spider genera. According to my own records and according to literature, 49 species of these genera are known to be present in Türkiye.

Acknowledgments

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New record of genus *Micaria* from Türkiye (Araneae: Gnaphosidae)

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Abstract

A new record of the genus *Micaria* Westring, 1851, *Micaria silesiaca* L. Koch, 1875, is identified as a new record for the Turkish araneofauna. Its morphology is briefly described and illustrated.

Keywords: Araneae, Gnaphosidae, *Micaria*, fauna, new record, Türkiye.

Introduction

Family Gnaphosidae is represented by 2478 species belonging to 153 genera worldwide (World Spider Catalog, 2024). There are 164 species in 34 gnaphosid genera listed for Türkiye (Seyyar, 2022; Danışman *et al*., 2024). So far, ten species have been described in genus *Micaria* Westring, 1851 from Türkiye. In the present study, *Micaria silesiaca* L. Koch, 1875 is recorded for the first time from Türkiye.

Material and Methods

Specimens were collected by hand aspirator from Rize province (Eastern Black Sea Region). They were preserved in 70% ethanol. SZX-16 Olympus stereomicroscope was used for identification. Examined specimens were deposited at Bayburt University, Bayburt, Türkiye (BAYU). Measurements are in millimetres. World distribution of the new record follows the World Spider Catalog (2024). Habitus and copulatory organs were photographed and mainly compared with Thaler & Noflatscher (1990), Heimer & Nentwig (1991) and Tuneva (2007).

Results

Micaria silesiaca L. Koch, 1875 (Figs. 1A-F)

Material examined: Türkiye, Rize province, Çamlıhemşin district, Ceymakçur plateau (40°54'15.1"N, 41°10'20.8"E), 2120 m., 29.07.2024, 1♀; Rize province, Çamlıhemşin district, Avusor plateau (40°56'56.7"N, 41°11'31.1"E), 2450 m., 29.07.2024, 1♀. Leg. N. Demircan Aksan.

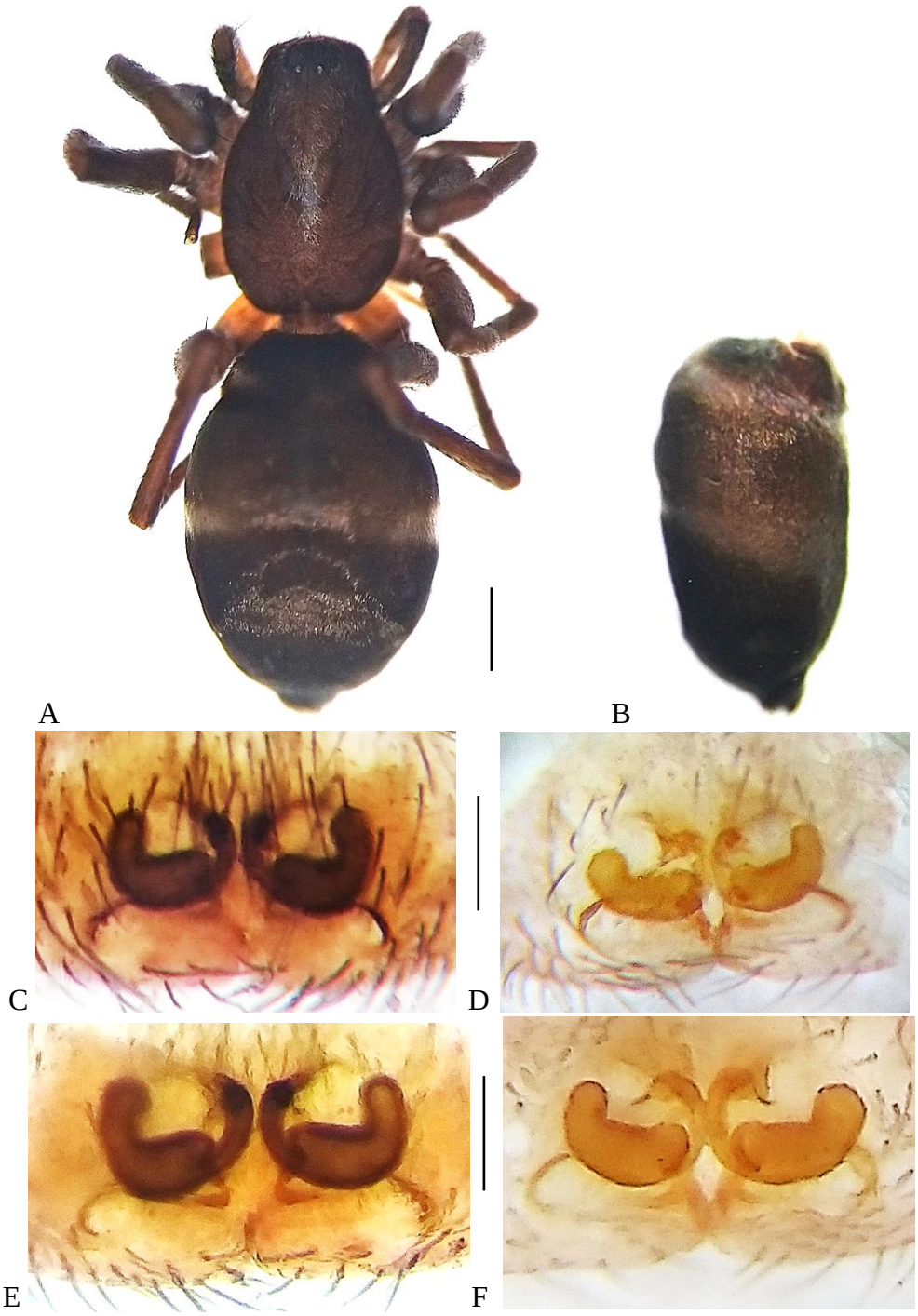

Fig. 1 *Micaria silesiaca* L. Koch, 1875. A. Habitus, dorsal view. B. Opisthosoma, lateral view. C, E. Epigynes, ventral view. D, F. Vulvae, dorsal view. (Scale bars: A-B. 0.5 mm, C-F. 0.1 mm).

Description: Female (Figs. 1A-F): Total length 4.2 mm. Carapace 1.6 mm long. Abdomen 2.6 mm long. Colouration: Carapace and abdomen dark brown. Abdomen with a median white line and two anterior white spots. Legs brownish. Epigyne with large epigynal pockets and copulatory openings. Epigyne and vulva are similar to those of *Micaria albovittata* (Lucas, 1846), *M. fulgens* (Walckenaer, 1802), and *M. pulicaria* (Sundevall, 1831). The finding of male/s from the same localities will support the record of *M. silesiaca* from Türkiye.

Distribution: Europe, Caucasus, Russia (Europe to South Siberia) (World Spider Catalog, 2024) and Türkiye (New Locality).

In this study, *Micaria silesiaca* L. Koch, 1875 is recorded for the first time from Türkiye. Therefore, the known species of the genus *Micaria* is raised to 11 in Türkiye. The total number of species of this family recorded from Türkiye is now 165 species.

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Notes on the life cycle of *Theridion jordanense* Levy & Amitai, 1982 (Araneae: Theridiidae)

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Abstract

Several spider taxa are specialized to prey on insects and mites. *Theridion jordanense* Levy & Amitai, 1982 (Theridiidae) used to found among Pomegranate trees (*Punica granatum*) cultivated in the experimental station of the Faculty of Agriculture, Cairo University, Giza Governorate, Egypt. Its life cycle was studied under laboratory conditions of 25±2°C and 65±5% R.H. in September, 2018. Males reached maturity after four spiderlings (158.9±1.8 days), and females passed through five spiderlings (212.5±1.2 days). All different spiderlings were reared on the movable stages of two-spotted spider mites, *Tetranychus urticae* C.L. Koch, 1836. Food consumption was also studied.

Keywords: Feeding, Food consumption, Life cycle, Mating behaviour, Spiders, *Tetranychus urticae*, Theridiidae, *Theridion jordanense*, Egypt.

Introduction

Spiders play an important role in agricultural ecosystems. They are generalist predators feeding on insects and some other arthropods such as mites. Biological aspects of spiders have received considerable attention (Stiles & Coyle, 2001). Family Theridiidae Sundevall, 1833 is one of the most diverse spider families. It includes 129 genera and 2579 species over the world (World Spider Catalog, 2024). Fourteen genera

and twenty nine species have been recorded in Egypt (El-Hennawy, 2017). The spider genus *Theridion* Walckenaer, 1805 is a cosmopolitan genus and has 582 species, which recorded all over the world (World Spider Catalog, 2024) and many of its species are abundant in favourable habitats. There are six species of genus *Theridion* recorded from Egypt (El-Hennawy, 2017).

Theridion jordanense Levy & Amitai, 1982 was recorded for the first time from Giza governorate, Egypt by Thaler-Knoflach & El-Hennawy (2012) then recorded from other locations; Cairo and Sadat City (El-Hennawy, 2017).

This study aimed to give some notes on the life history of this species as a step to understand its behaviour and role in natural control to reduce the numbers of the two-spotted spider mite. This species prefers to construct webs on low vegetation. It could be used as an agent for shrub pests. Therefore, it seems to be a suitable environment for its existence.

Material and Methods

Theridion jordanense individuals were collected from Pomegranate trees, *Punica granatum* L. (Fig. 1), cultivated in the experimental station of the Faculty of Agriculture, Cairo University, Giza Governorate during September 2018.

Fig. 1. Photo of the Pomegranate trees, *Punica granatum* L.

Many individuals of *T. jordanense* were collected from Pomegranate trees by hand sorting method then transferred to the laboratory. After identification, three gravid females of them individually reared each in a plastic vial, fed on spider mites until laying egg sacs which were observed till hatching. The hatched spiderlings from three egg sacs were counted and each one was individually kept in a separate vial. Life cycle was conducted under laboratory conditions at 25±2°C and 65±5% R.H. Fifty spider individuals were reared until adulthood. Number of the movable stages of *Tetranychus urticae* was given as a prey for each instar up to adult stage. The developmental periods, number of moults and number of consumed prey for each stage of spiders were recorded. The life cycle carried out mean and standard deviation of all stages were calculated.

Results

Egg sac, eggs and incubation period

The egg sac was spherical in shape, small in size and whitish yellow in colour at first and became dark before hatching (Fig. 2).

Fig. 2. Female of *Theridion jordanense* with egg sac.

The eggs inside the egg sac were circular and yellow in colour at the beginning and became darker before hatching. Eighty three individuals, with an average of 27.6 individuals from three egg sacs, hatched through a round pore at the tip of each egg sac. After rearing, 50 individuals reached adulthood. The incubation period of eggs lasted 11-14 days for the three egg sacs with an average of 12 days.

Spiderlings

Through rearing the spiderlings of *T. jordanense*, 20 spiderlings passed through 4 spiderlings then became males, while 30 spiderlings passed through 5 spiderlings before reaching the adulthood of females (Fig. 3) during their developmental periods (Table 1).

A B

Fig. 3. *Theridion jordanense*. A. Adult male. B. Adult female.

Table 1. Life Cycle of the theridiid spider *Theridion jordanense* when fed on the two spotted spider mites *Tetranychus urticae*.

Developmental Stage	Duration (Days)							
	Male				Female			
	Min	Max	Mean	S.D.	Min	Max	Mean	S.D.
1st Instar	22	27	23.7	1.8	20	25	23.7	1.5
2nd Instar	34	38	36.8	1.3	34	39	37.6	1.6
3rd Instar	37	42	39.1	1.6	39	42	40.8	1.2
4th Instar	45	50	48.4	1.9	48	50	49.1	0.8
5th Instar	-	-	-	-	49	51	50.3	0.9
Life Cycle	156	162	158.9	1.8	211	215	212.5	1.2

Sex ratio
The sex ratio of adults was 1: 1.5 (male: female).

Feeding behaviour
The spider attacks the mite from the anterior part of the body and turns the prey more than once before sucking its digested contents.

Food consumption
The mean total number of consumed spider mite individuals averaged 286.9±1.2 and 314.6±0.8 individuals for the total spiderlings of male and female, respectively when fed on the individuals of the spotted spider mite, *Tetranychus urticae*. Otherwise the average of the total number of consumed prey through the life cycle was 694.8±1.7 and 1058±1.4 prey for male and female with a daily rate (D. rate) of 4.4 and 5.0 prey for male and female, respectively (Table 2).

Table 2. Food consumption of the spider species *Theridion jordanense* when fed on the two spotted spider mites *Tetranychus urticae*.

Developmental Stage	Number of consumed individuals of prey									
	Male					Female				
	Min	Max	Mean	S.D.	D. rate	Min	Max	Mean	S.D.	D. rate
1st Instar	60	63	61	1.3	2.6	72	75	73.3	1.2	3.1
2nd Instar	144	146	145.2	0.8	4	148	150	149	0.8	4
3rd Instar	200	204	201.7	1.7	5.2	207	210	209.2	1.2	5.1
4th Instar	285	288	286.9	1.2	5.4	310	312	311.6	0.7	6.4
5th Instar	-	-	-	-	-	312	315	314.6	0.8	6.3
Life Cycle	692	698	694.8	1.7	4.4	1056	1062	1058	1.4	5

Discussion

The number of emerged spider individuals from three egg sacs (83 individuals) differed from Sallam *et al*. (2015) who recorded 28 individuals from two egg sacs of the same species. Otherwise, the present results agree with Sallam *et al*. (2015) who found the number of moults of spiderlings was 4 and 5 for male and female, respectively. Also, the result for the life cycle and food consumption of *T. jordanense* feeding on *T. urticae* differed with Sallam *et al*. (2015) who reared *Theridion jordanense* on the larvae of the leaf cotton worm, *Spodoptera littoralis* Boisduval, 1833. Hence, the difference is related to the different kind of prey.

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Pterotricha dalmasi Fage, 1929 in Jordan (Araneae: Gnaphosidae)

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Abstract

Pterotricha dalmasi Fage, 1929 of family Gnaphosidae is recorded from Wadi Rum, Jordan. Only one adult male specimen of this species was found in May 2024 inside a tent in Wadi Rum. Its illustrations and measurements are presented. It is the second record of this species from Jordan. The first record was from a place near Ma'an. Four *nomina dubia* of *Pterotricha* species are proposed.

Keywords: Araneae, Gnaphosidae, *Pterotricha dalmasi*, Jordan.

Introduction

Genus *Pterotricha* Kulczyński, 1903 of the big family Gnaphosidae Banks, 1892 (2479 species in 153 genera) includes 44 species in the World (World Spider Catalog, 2024). These species may be called "long-tailed ground spiders" because of their long anterior lateral spinnerets. They are widely distributed in African, Asian, Mediterranean, and some European countries [3 continents - 37 countries] as follows:

AFRICA (12 countries)
Algeria [4], Botswana [1], Egypt [6], Ethiopia [1], Lesotho [1], Libya [6], Mauritania [2], Morocco [1], Somalia [2], South Africa [2], Sudan [2], Tunisia [1].

ASIA (17 countries)
Afghanistan [1], Azerbaijan [1], India [1], Iran [5], Iraq [5], Japan [1], Jordan [1], Lebanon [2], Palestine/Israel [12], Saudi Arabia [2], Syria [2], Tajikistan [1], Türkiye [4], Turkmenistan [1], United Arab Emirates [6], Uzbekistan [1], Yemen [2].

EUROPE (8 countries)
Cyprus [2], Greece [1], Italy [1], Montenegro [1], Portugal [2], Russia (Europe) [1], Serbia [1], Spain [1]. [Number of species]

The most widely distributed species of genus *Pterotricha* in the world is *Pterotricha dalmasi* Fage, 1929. It is recorded from nine countries: Algeria, Egypt, Sudan, Palestine/Israel, Jordan, Saudi Arabia, United Arab Emirates, Iraq, and Iran.

Pterotricha dalmasi was recorded from Jordan by Levy (1995). It was from a place near Ma'an (?). The sample studied in this new work was found in Wadi Rum, south of Jordan. It has a known place and date of collecting. This record confirms the presence of the species in Jordan (Fig. 1).

Only three species are reported from family Gnaphosidae in Jordan. They are: *Haplodrassus mediterraneus* Levy, 2004, *Pterotricha dalmasi* Fage, 1929, and *Zelotes scrutatus* (O. Pickard-Cambridge, 1872) (El-Hennawy, 2020, 2023).

Abbreviations used: ACE = Arachnid Collection of Egypt, AL = abdomen length, CL = carapace length, CW = carapace width, TL = total length.

All measurements are in millimetres (mm).

Fig. 1. Distribution map of *Pterotricha dalmasi* Fage, 1929 in Jordan: Ma'an and Wadi Rum. (Map after NordNordWest/Wikipedia)

Family **Gnaphosidae** Banks, 1892
Genus ***Pterotricha*** Kulczyński, 1903
Pterotricha dalmasi Fage, 1929
Figs. 2-7.

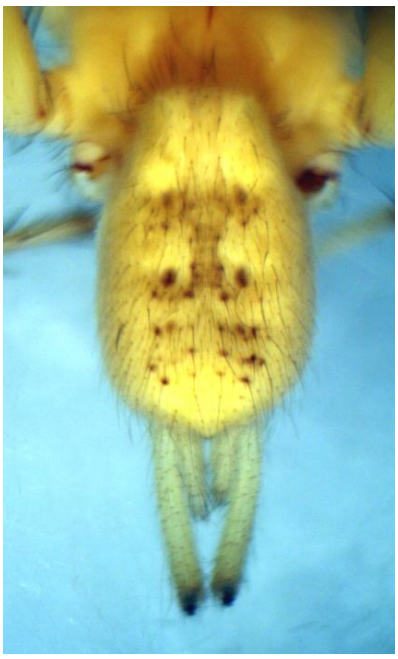
Material examined. Jordan, 1♂, Wadi Rum (29°29'12.0"N, 35°30'51.0"E elev. 1067 m), 3 May 2024, at night inside a tent, leg. Rafel Melhem [ACE.2024.05.03.AR.001.JOR].

Measurements: ♂ TL 6.4, CL 3.4, CW 2.7, AL 3.5 (1.5 without spinnerets, longest spinnerets are the tube-shaped anterior lateral spinnerets).

2

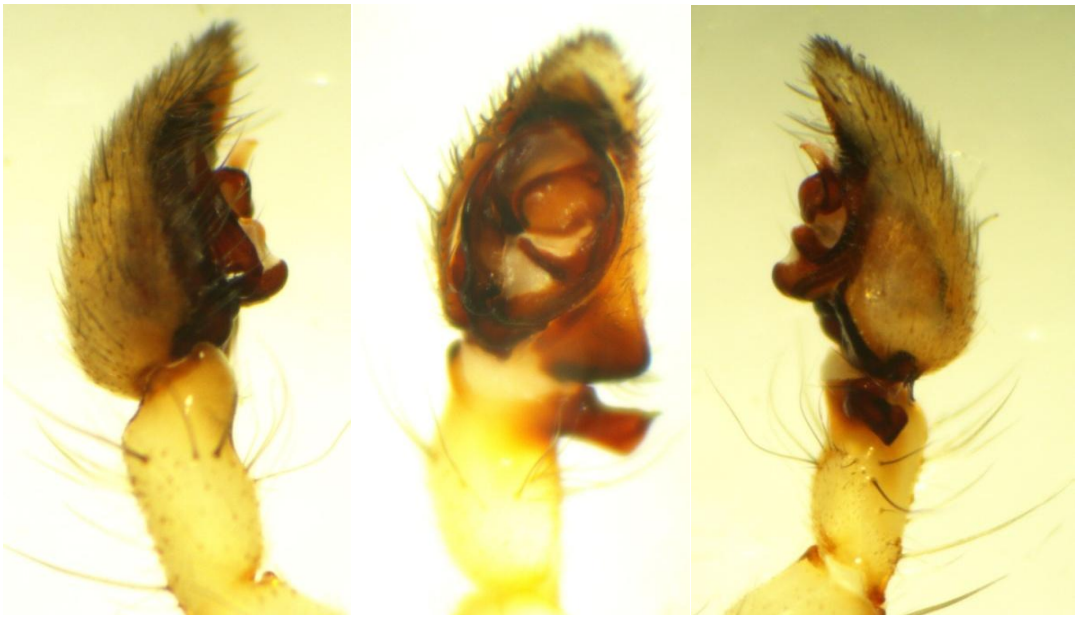
Figs. 2-7. *Pterotricha dalmasi* Fage, 1929, ♂ from Wadi Rum. 2. habitus, lateral view.

3



4

3. cephalothorax, dorsal view. 4. abdomen, dorsal view.



5 6 7

5-7. Palpal organ. 5. prolateral view. 6. ventral view. 7. retrolateral view.

Male lateral habitus, cephalothorax, and abdomen (Figs. 2-4).
Male palp. see Figs. (5-7).

For the description of *Pterotricha dalmasi*, see:
Pterotricha dalmasi Fage, 1929: 252, f. 5 (D♂).
Pterotricha isiaca Denis, 1947: 63, pl. 4, f. 5 (♂).
Pterotricha dalmasi Levy, 1995: 948, f. 71-76 (♂, D♀).
Pterotricha dalmasi El-Hennawy, 2014: 26, f. 1-6 (♂♀).
Pterotricha dalmasi Siyam, Dunlop & Jäger, 2017: 320, f. 7-9 (♂).
Pterotricha dalmasi Zamani, 2018: 159, f. 1f-g, 2e, 3e, 4e-f (♂♀).
Pterotricha cf. *dalmasi* Zamani *et al.*, 2018: 19, f. 1a-f (♀).
Pterotricha dalmasi Zamani *et al.*, 2022: 146, f. 1E, 2D, 3C, 5A-C (♂♀).
(World Spider Catalog, 2024).

Nomina dubia

I. Among the 44 species of genus *Pterotricha*, there are 21 species described from both the male and the female, 10 from the male only, 10 from the female only, and 3 from juveniles. The description based on immature specimen is useless unless we obtain adult specimens that agree with this description so that we can repeat the description including a description of the external genitalia, i.e. male's palp and female's epigynum.

The three juvenile *Pterotricha* species are: *P. arcifera* (Simon, 1882) and *P. punctifera* Dalmas, 1921 from Yemen, and *P. sinoniae* Caporiacco, 1953 from Italy (Simon, 1882; Dalmas, 1921; Caporiacco & Denis, 1953). Their descriptions are based on immature specimens. These three species are indeterminate, they may be temporarily treated as *nomina dubia* until getting new congener males and females from the same localities to redescribe the species.

II. Dönitz & Strand described *Callilepis saga* from Japan (in Bösenberg & Strand, 1906) without illustrations of genitalia. Roewer transferred this species to genus *Pterotricha* in his Katalog der Araneae, 2 Band, Abt. a (Roewer, 1955). This transfer is doubtful.

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